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RAPID GRAPHICAL COMPUTATION OF SMALL COLOR DIFFERENCES

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INTRODUCTION

THE accurate quantitative measurement of color represents a triumph over one of the most challenging of scientific endeavors. Numerous and varied types of colorimetric devices have been designed and, for the most part, usually operate on differing principles of color specification. Probably the most widely used instrument for the measurement of color is General Electric Company's Recording Spectrophotometer. With this apparatus, the reflectance curve of any color sample is automatically drawn for all wave lengths of the visible spectrum. With experience, it is possible to look at the spectrophotometric curve and make a qualitative estimate as to what color it represents. Alone, however, these data do not provide direct quantitative designations that could be used to evaluate color. Therefore, it is necessary to resolve the curves into other terms which will lend themselves to easier interpretation.

One such means of utilizing the spectrophotometric data is based on the CIE (Commission Internationale de l'Eclairage) system. By this method, all colors can be matched by some combination of three primary colors. The primary stimuli, X, Y, and Z, are fixed by agreement, and all other colors are regarded as containing fractional amounts of these three values depending on the characteristics of the sample color. Thus, if two samples were found to have identical X, Y, and Z values, these colors would match provided conditions of lighting, viewing, pigmentation, etc were the same.

While the X, Y, and Z primaries cannot be produced in a practical manner, they can be considered as parallel to red (X), green (Y), and blue (Z) colors. From these values, trichromatic coordinates x, y, and z, are calculated. The x and y coordinates of the CIE systems define any position on the chromaticity diagram (Figure 1). When a third variable, the tristimulus Y value (lightness), is coupled with the chromaticity diagram, the combination defines the construction of the CIE color solid (Figure 2). Thus, the location within the solid of any imaginable color can be ascertained through a knowledge of the chromaticity coordinates and lightness (*1*, *2*).

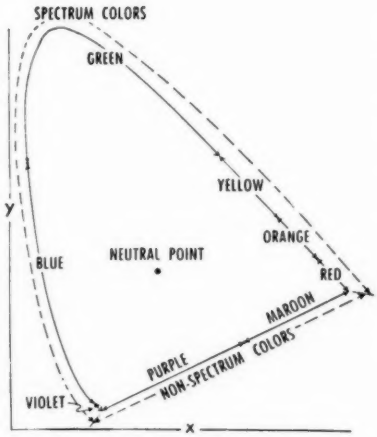


Figure 1

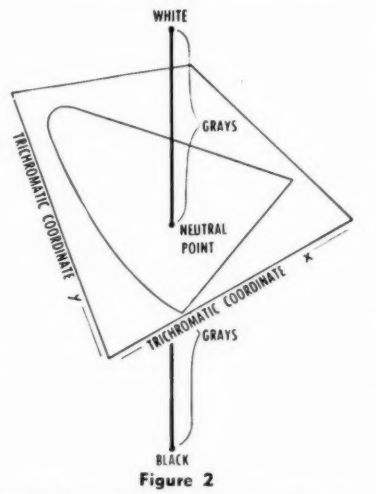


Figure 2

The calculation of the tristimuli values, X, Y, and Z is achieved by the integration of the spectrophotometric curve. Several methods for integrating such curves have been described (*2*), but these are cumbersome and time-consuming. On the other hand, considerable efficiency can be realized by the use of a Libra-scope Integrator attachment for the spectrophotometer. This device automatically and rapidly performs the desired computation while the curves are being drawn. The resulting quanitative values of X, Y, and Z are then used to calculate the CIE trichromatic coordinates, x, y, and z, in the following manner:

$$x = X/(X+Y+Z)$$
$$y = Y/(X+Y+Z)$$
$$z = Z/(X+Y+Z).$$

Although the tristimulus values referred to in this article are those derived from spectrophotometric data, this does not preclude the use of colorimeters, which are provided with simple formulas for numerically transforming instrument scale readings into the CIE system of X, Y, and Z. Thus instruments less expensive than the basic spectrophotometric-integrator combination may be used to advantage and the data would suffer only by the small inaccuracies introduced by the instrument to CIE transformation, which are generally of small consequence in small color difference work.

DISCUSSION

COLOR DIFFERENCE———While the CIE system is fundamental to the interpretation of color, the problem of relating one color to another within the color solid had to be overcome. The perfection of such a relationship for measuring color differences was further complicated because this relationship had to be a quantitative definition of difference between colors in visual terms, since the dimensions within the CIE color solid are not visually linear. If this difficulty could be surmounted, industry would have a much-needed tool for closely controlling color variations in manufacturing processes. Visual color differences can be established on an essentially empirical basis by a determination of the smallest distinguishable difference an observer can perceive. Such a survey of the lightness, or gray, scale was performed by Munsell, Sloan, and Godlove (*3*). Later, a similar examination was made of the chromaticity diagram by MacAdam (*4, 5*). It is a combination of these two scales that is needed to describe a solid which would be linear in visual terms. MacAdam's outstandingly thorough survey of the chromaticity diagram in 1942, was performed by taking the standard deviation of match for a number of colors using a specially designed colorimeter. He further reported that the "Just Noticeable Difference" limits of a given color described an ellipse on the chromaticity diagram and, consequently, an ellipsoid in the CIE solid. By orthographically projecting this ellipsoid as described by Goodwin (*6*), colorimetrists were able to supply quantitative limits to color variation and use these to maintain control during manufacturing processes. On the other hand, this method, and modifications thereof, still required anywhere from 5 to 10 minutes per calculation due to the complexity of the system. A further limitation of this procedure was the lack of sufficient detail in coverage of the chromaticity diagram by the 25 ellipses reported by MacAdam (*5*) in 1945 as an elaboration of his original work. About 75 more ellipses would be required in order to achieve what might be termed sufficient accuracy. Thus, the quest continued for a more economical method, one that would have a high degree of facility and usefulness.

OBLIQUE COORDINATES——— When Davidson and Hanlon (*7*) described the application of the MacAdam data to measurement of color differences, their recommendations seemed to answer the problem at hand. The type of chart which they used was originally suggested by MacAdam (*5*), but this fact had been ignored until they described their work as an actual accomplishment. The basis of this method makes use of the constants g_{11}, g_{22}, and $2g_{12}$ that describe the MacAdam ellipses. A derivation of these constants can be used to modify and translate the rectangular chromaticity coordinates so that the original ellipses plot as circles in the oblique transformed coordinates. An example of this transformation is shown in the Appendix.

These oblique chromaticity charts are defined by the following:

Angle between coordinates,
$$x \text{ and } y = \text{Arccos } g_{12}/(g_{11}\, g_{22})^{\frac{1}{2}}$$
Spacing of abscissa, $x = (g_{11})^{\frac{1}{2}}\Delta x$
Spacing of ordinate, $y = (g_{22})^{\frac{1}{2}}\Delta y$

Where g_{11}, g_{22}, and g_{12} are read from the charts constructed by MacAdam (*5*), and Δx and Δy are the scale spacing of x and y chosen to equal one unit. The chromaticity charts are designed around the engineer's standard 20 scale or one-half inch per unit color difference.

The adaptation of this method by Union Carbide Corporation was begun with the basic data published by MacAdam. In establishing a set of charts, it was evident that new computations had to be made to comply with changes in the numerical value of the constants. There is a practical limit, however, which determines the amount of detail that is necessary to cover the chromaticity diagram. It was felt that the same color difference (x, y) plotted on adjacent charts should not differ by more than 12.5 percent to avoid large interpolative errors. If the CIE chromaticity diagram is partitioned into adjoining rectangles, and the values of g_{11}, g_{22}, and g_{12} are essentially constant within each partition, the diagram appears as shown in Figure 3. The criterion which is used to determine the degree of interpolation necessary to achieve adequate coverage of the CIE chromaticity diagram is indicated by the numbers given in the rectangles of Figure 3. Unit diagonal distances were computed for chromaticity values to the nearest 0.100 in terms of x and y. If the adjacent values differed by more than 25 percent for either diagonal, the value of the intersection half-way between the original ones was obtained. This subdivision was repeated when necessary to the nearest 0.025, so that all but two cases met the interpolation limit. The total number of charts needed to cover the entire diagram then becomes 89. All of these charts are available from the Bakelite Publicity Dept, 30 E 42nd St, New York, NY.

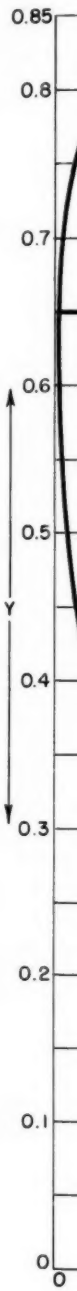
The numbers appearing in the cells of Figure 4 are the designations assigned to the chromaticity chart for that region. They are derived from the x and y coordinate of the central calculated point of that region. For example, Figure 5 (chart 3530) is used for the partition in which x= 0.350 and y=0.300. As mentioned above, the diagram supplies only chromaticity differences. To complete the color solid, an additional dimension, lightness, had to be introduced. This scale, illustrated in Figure 6, is based on 0.04 Munsell V_T units that equal one Just Noticeable Difference Unit. In passing, it should be mentioned that the size of the lightness scale recommended by Davidson and Hanlon is 0.06 Munsell V_T units.

EFFECT OF LIGHTNESS ON CHROMATICITY DIFFERENCE ———Independently, both Davidson and Hanlon (*7*) and the authors discovered that chromaticity differences, as plotted on the MacAdam Uniform Chromaticity chart, had to be corrected for differences in levels of lightness. If such a correction is not applied, disproportionate weighting is given to a dark color, such as brown. For these colors, the numerical weight given to the chromaticity difference, ΔC is too large compared with the lightness difference, ΔL. Therefore, the total color difference, ΔA, is not the same when dark colors are compared with light colors.

To allow for this situation, the authors based their correction factor on the average chroma spacing from neutral to chroma /2 which is given in the Munsell Renotation data (*8*). The procedure for introducing this correction into the color difference calculation was incorporated into a set of thirteen Color Difference Calculating Charts so as to reduce to a minimum the labor of calculation and the possibility of computation errors. These charts, along with the respective range of Y values for which each is valid, are listed in Table I. The introduction of this modification for calculating small color difference represents an improvement that provides better agreement between numerical color data and visual observations.

TABLE I
List of Color Difference Calculating Charts

Chart letter	*Range of Y values*
F	0.012–0.026
G	0.025–0.045
H	0.042–0.075
I	0.070–0.115
J	0.110–0.165
K	0.160–0.230
L	0.220–0.300
M	0.290–0.390
N	0.380–0.500
O	0.490–0.620
P	0.610–0.770
Q	0.750–0.925
R	0.875–1.025



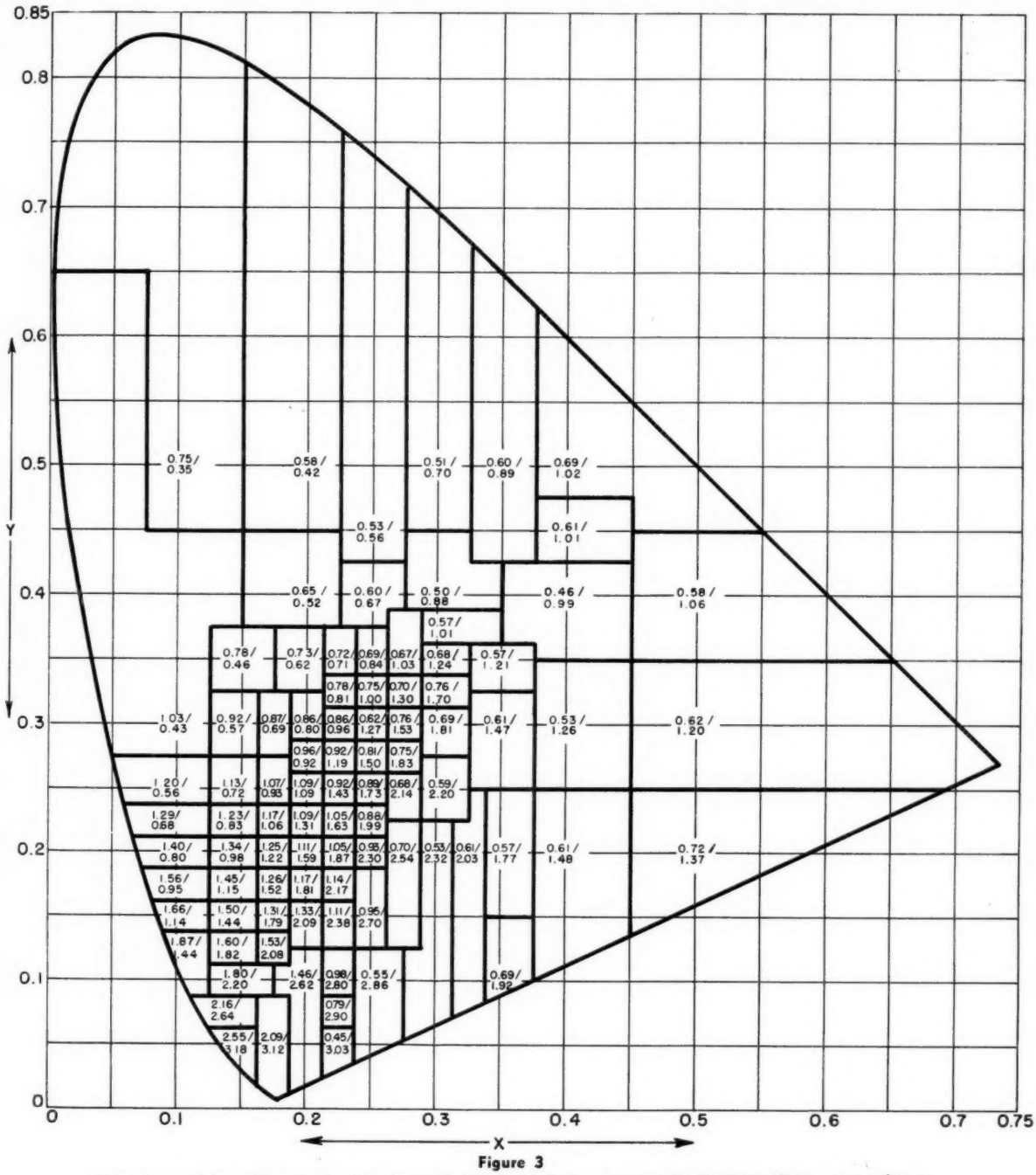
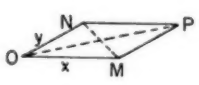


Figure 3

CIE chromaticity diagram showing interpolation needed for coverage by Uniform Chromaticity Charts
Numbers given in chart: unit diagonal distances of oblique coordinates
OP/NM



UCC METHOD——The method whereby the chromaticity difference is combined with the lightness difference was originally suggested by Davidson and Hanlon and adopted by Goodwin. In principal, the chromaticity difference is determined from the proper chromaticity chart (Figure 5). The lightness difference is plotted on the abscissa of the proper calculating chart (Figure 6). The chromaticity difference is then plotted as the ordinate on the Color Difference Calculating Chart, and the hypotenuse of the right triangle, so formed, represents the total color difference. The corrected chromaticity difference value can be read from the Calculating Chart by measuring the vertical coordinate with a 20 scale. The example that follows illustrates this procedure in detail.

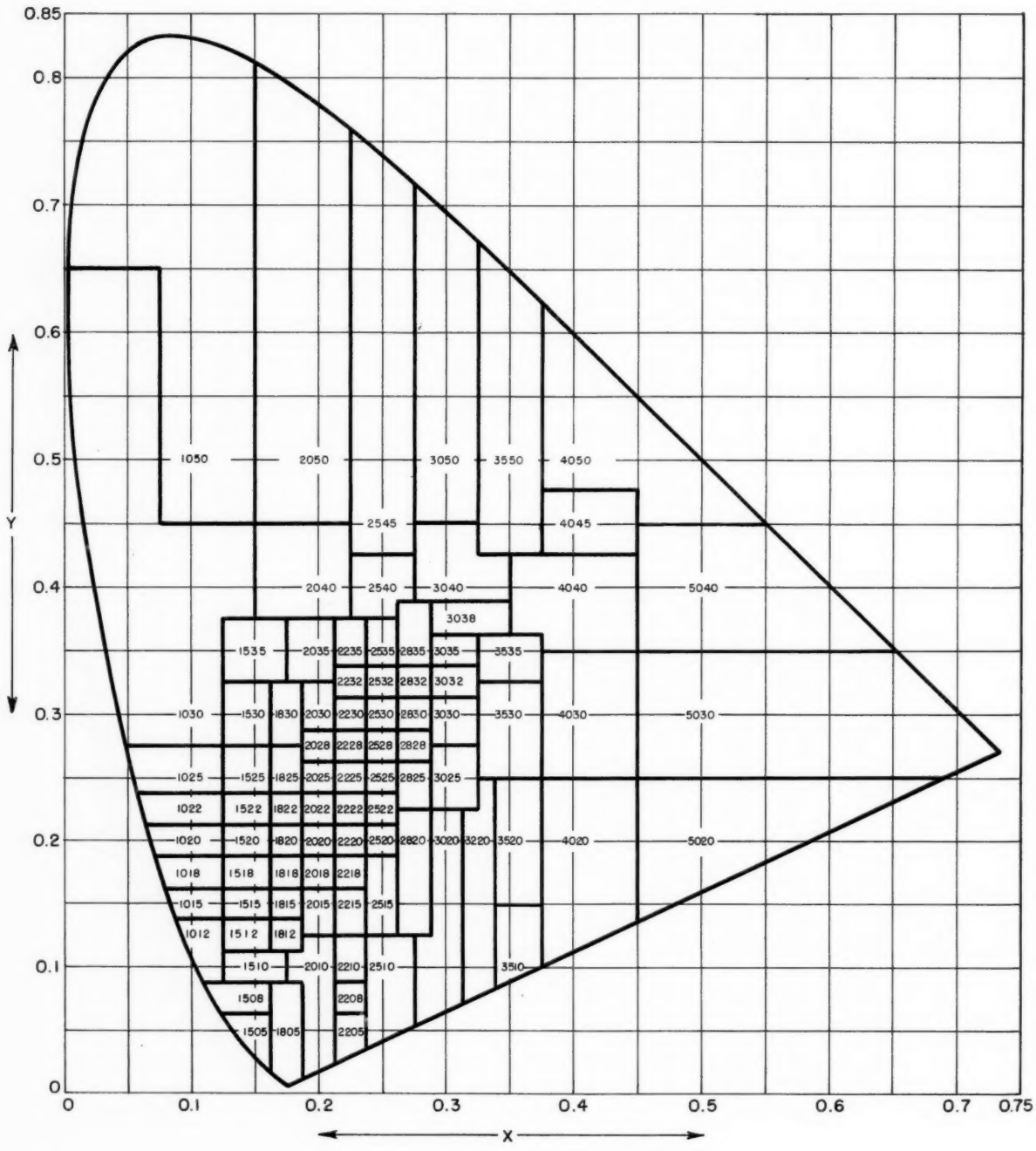


Figure 4
CIE chromaticity diagram
Map of areas covered by Uniform Chromaticity Charts

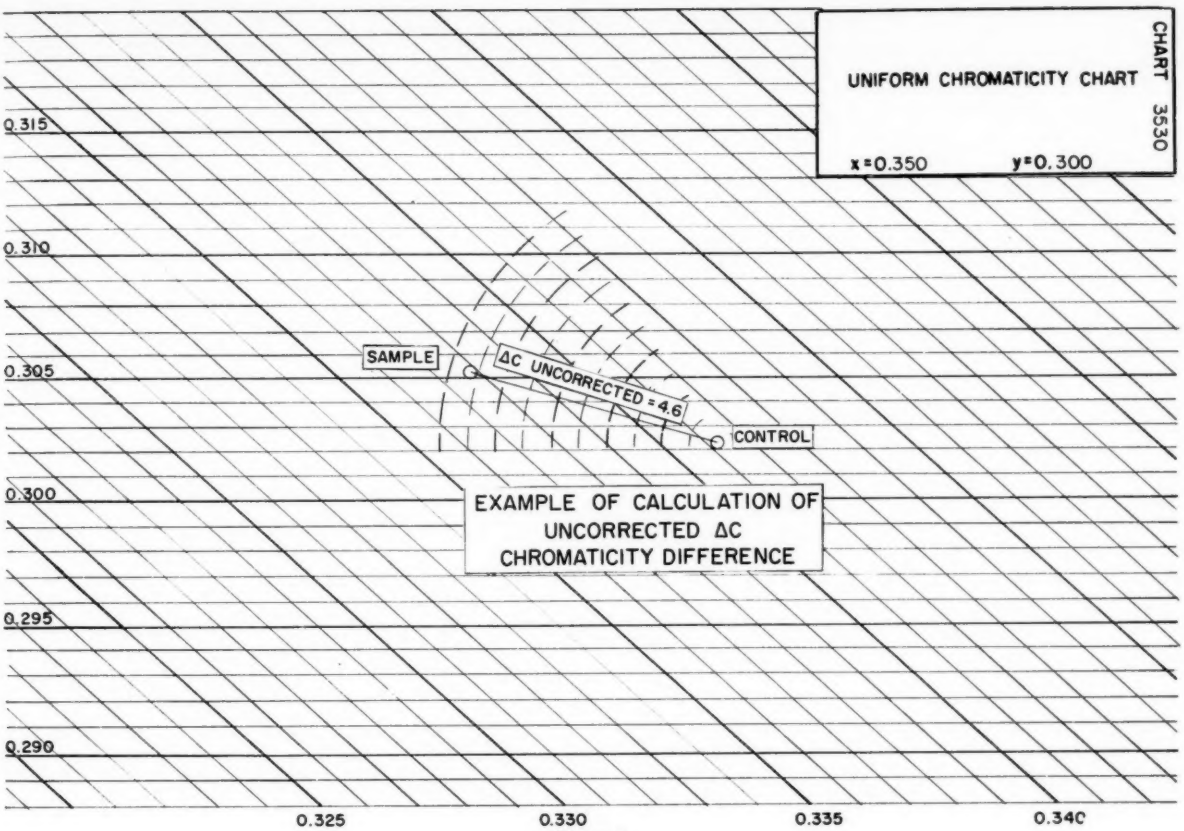


Figure 5

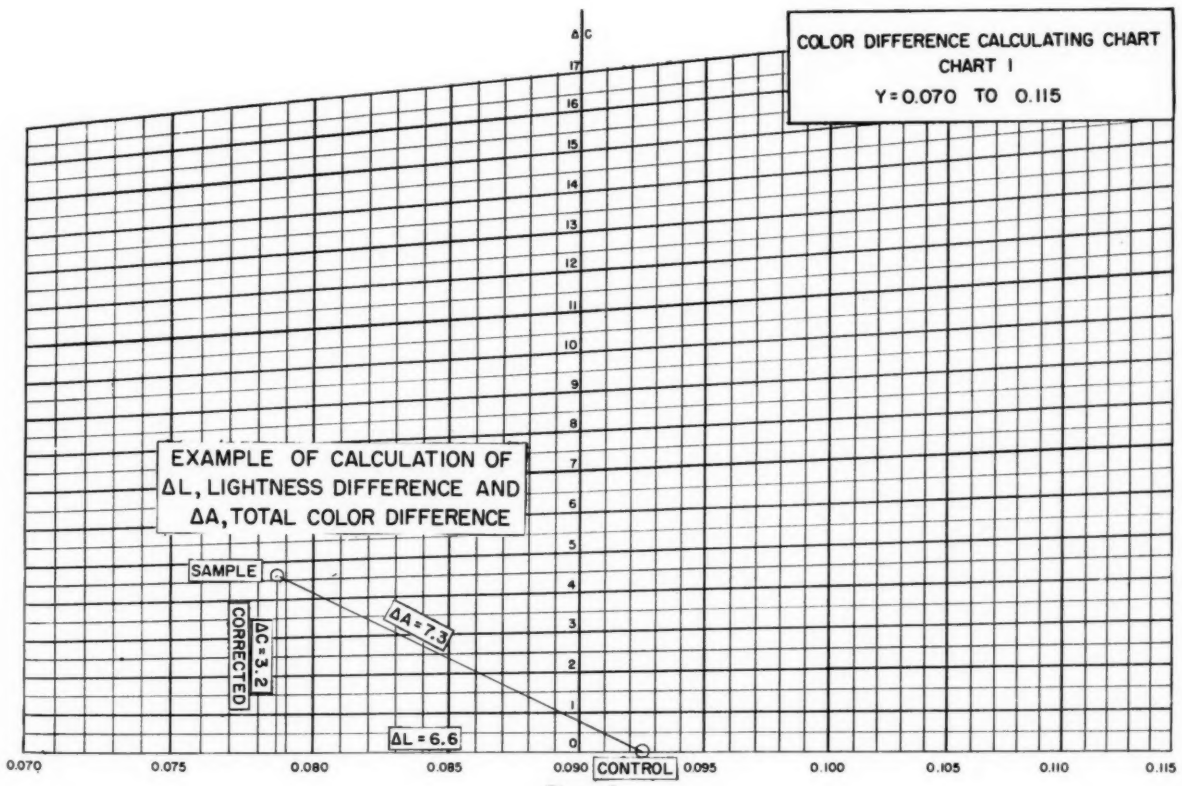


Figure 6

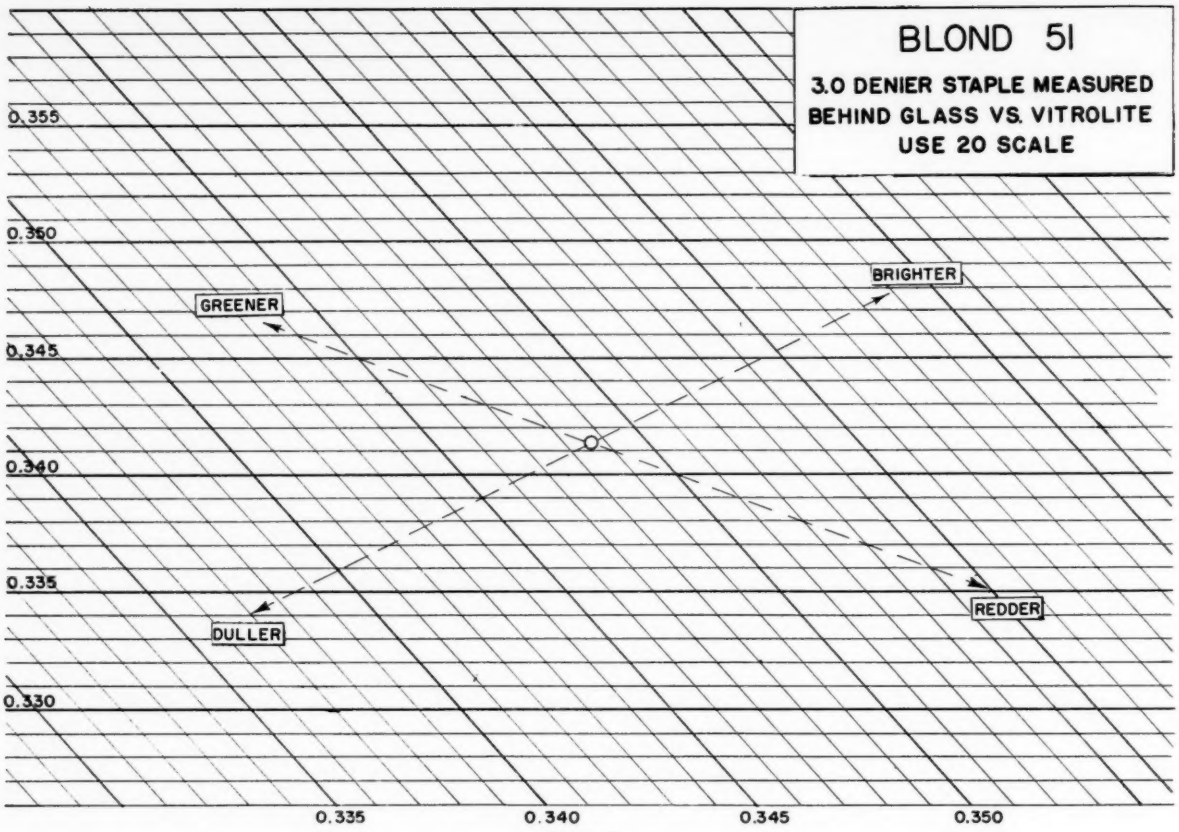


Figure 7

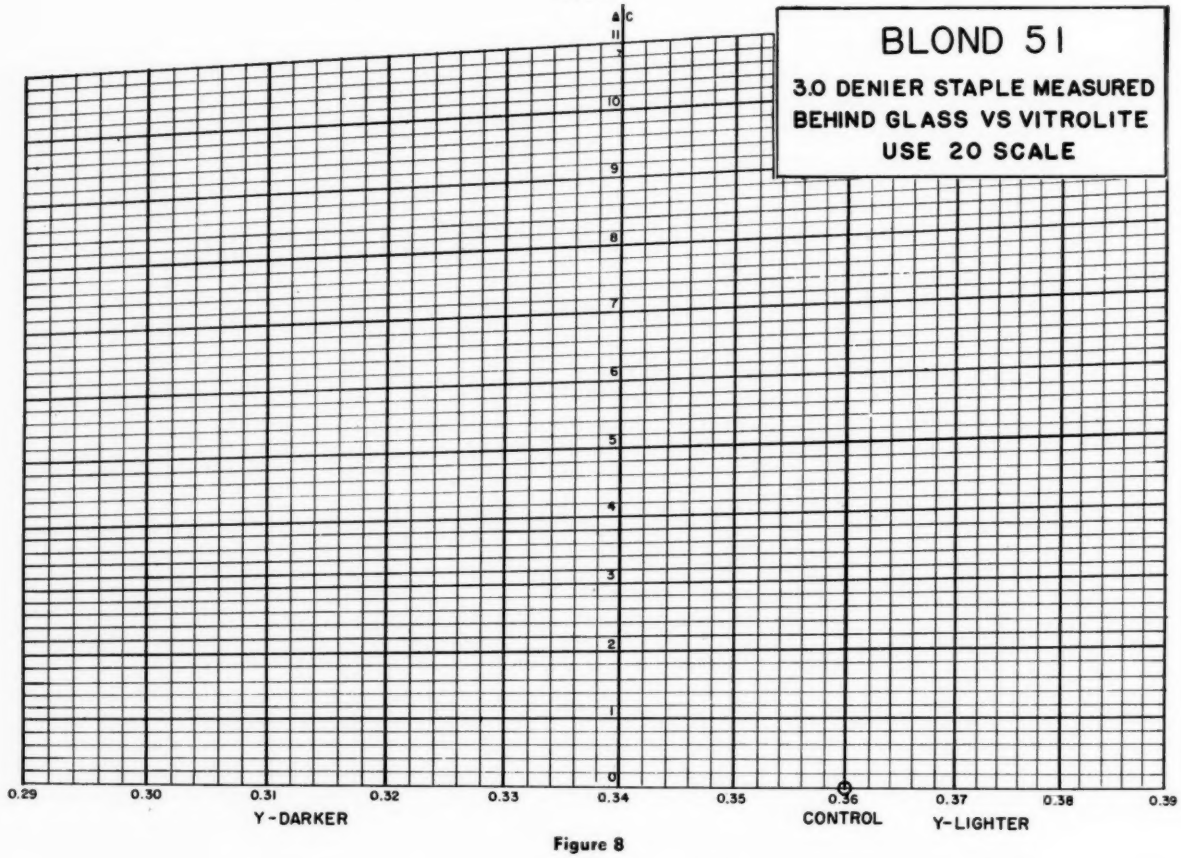


Figure 8

Sample Calculation

1) Given CIE data which has been measured on the GE Spectrophotometer as follows:

		Control	*Sample*
a) Read from	X	0.1043	0.0870
Integrator	Y	0.0924	0.0787
Counters:	Z	0.1091	0.0921
b) Add X, Y and Z	Sum	0.3058	0.2578
c) Divide X/Sum =	x	0.3412	0.3379
d) Divide Y/Sum =	y	0.3022	0.3054

2) Select charts for color difference calculation—*use data given for control.*
   a) Locate proper Uniform Chromaticity Chart on map (Figure 4).
   Example: x = 0.3412,
   y = 0.3022
   —Chart 3530

3) Identify coordinates of the chart, placing control value as close to center of chart as possible (Figure 5).
   a) Every heavy line on the chromaticity chart equals 0.005 in x and y when the 20 scale is used (½" equals one △C Unit).
   b) The modulus of the color difference calculating chart is intended for use with the 20 scale. The proper chart is selected according to the CIE Y value.

4) Plot the chromaticity values, x and y, of the control and the sample on the Uniform Chromaticity chart (Figure 5).

5) Measure △ C, chromaticity difference, with a scale. Record the value of △ C. This is the chromaticity not corrected for lightness (Figure 5).
   Example:
   △ C (uncorrected) = 4.6

6) a) Plot CIE Y of the control on the base line of the Color Difference Calculating Chart (Figure 6).
   Example:
   Y = 0.0924
   b) Plot the sample on the calculating chart with its coordinates as Y and △ C (uncorrected) (Figure 6).
   Example:
   Y = 0.0787; △ C (uncorrected) = 4.6

7) Measure △L, Lightness difference, parallel to the base line with a scale. Record the value of △ L indicating whether it is darker or lighter than the control (Figure 6).
   Example:
   △ L = 6.6, Darker

8) Measure △ C, chromaticity difference (corrected), perpendicular from the base line with a 20 scale (Figure 6).
   Example:
   △ C (corrected) = 3.2

9) Measure △ A, total color difference, with a scale. Record the △ A value. This is the composite of △ C and △ L (Figure 6).
   Example:
   △ A = 7.3

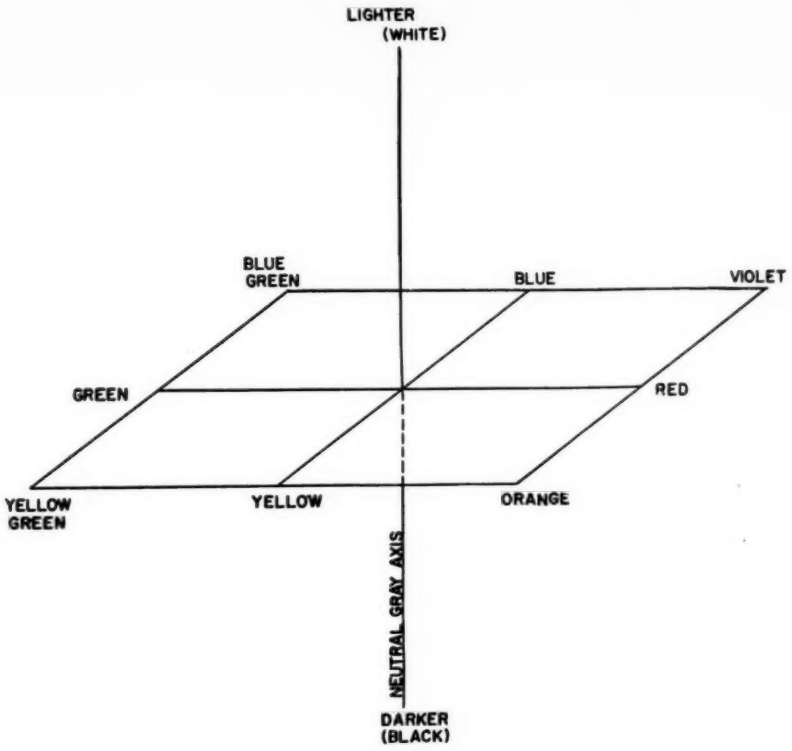


Figure 9
Standard color nomenclature

COMPUTATIONAL AIDS—— The chromaticity charts are designed around the standard engineer's 20 scale or ½" per unit color difference. This is based upon the smallest chart division equal to 0.001 in x or y. A simple substitute for the engineer's scale is any ordinary rule which is divided into tenths of an inch. Distances measured with this rule are divided by two to obtain the regular color differences.

The physical limits of one graph (8½" x 11") generally describe the useful range within the precision index of any chart. On some occasions, however, it may be desirable to reduce the scale value to some convenient sub-multiple such as 0.5 or 0.2 for large color differences. It then follows that with any coordinate spacing change, comparable adjustments must be made to the computing scale.

SPECIAL CHARTS —— When any color becomes well standardized, it is useful to identify the coordinates on both a Chromaticity Chart and Color Difference Calculating Chart, and have these charts printed in advance for quality control work.

A method to orient the chromaticity differences in color space can be provided in these special charts (Figure 7) by drawing the "iso-purity" and "iso-hue" lines that intersect at the control point. The "iso-purity" line divides the chromaticity plane into "brighter" and "duller," and the "iso-hue" line divides the area by adjacent hues. Lightness differences are described automatically by their position on the chart (Figure 8) relative to the control; Lighter is to the right and Darker to the left on the chart.

Such a method introduces, as a natural consequence, a four-primary color system where the primary hues are red, yellow, green, and blue (Figure 9).

CONCLUSION

The authors believe that the method outlined herein represents a considerable step forward in the technology associated with color measurements. Based on the CIE system, it permits the evaluation of quantitative data that have visual meaning with respect to the color solid. Its usefulness in the field of color control can be fully appreciated only when compared in actual use to existing methods. Control limits may be applied singularly to chromaticity difference, lightness, or over-all color difference; or simultaneously to all three measurements. Furthermore, these limits may be maintained on a practical quality control basis because of the ease and simplicity of the method. The long-familiar, time-consuming, color difference calculations can now be replaced with a rapid and valid graphical computation.

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(4) MacAdam, D L, *ibid* **32**, 247 (1942).

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(7) Davidson, H R, and Hanlon, J J, *J Opt Soc Am* **45**, 617 (1955).

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APPENDIX

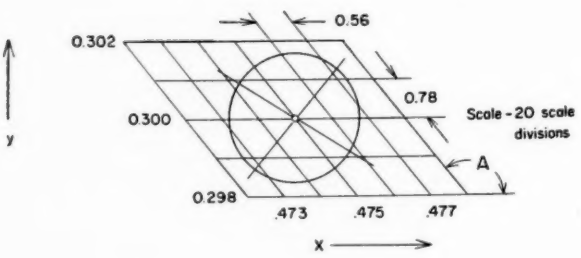
A.) Example of Calculation of Transformed Coordinates for MacAdam Uniform Chromaticity Chart

Given Data: Central Point Ellipse Constant

$x = 0.475$ $g_{11} = 32 \times 10^4$

$y = 0.300$ $g_{22} = 60.5 \times 10^4$

$2\,g_{12} = -55 \times 10^4$



1 Unit Radius Circle describes limits of 1 JND from center shown

Calculation of Chart Coordinates

Scale spacing of x axis

$$(g_{11})^{\frac{1}{2}}\,x = (32 \times 10^4)^{\frac{1}{2}} \times 10^{-3} = 0.56$$

Scale spacing of y axis

$$(g_{22})^{\frac{1}{2}}\,y = (60.5 \times 10^4)^{\frac{1}{2}} \times 10^{-3} = 0.78$$

Angle between axes, A

$$\text{arccos}\ g_{12}/(g_{11}-g_{22})^{\frac{1}{2}}$$

$$A = \text{arccos}\ \frac{-27.5 \times 10^4}{(32 \times 60.5 \times 10^8)^{\frac{1}{2}}}$$

$$A = \text{arccos}\ -0.625$$

$$A = 128.7^\circ$$

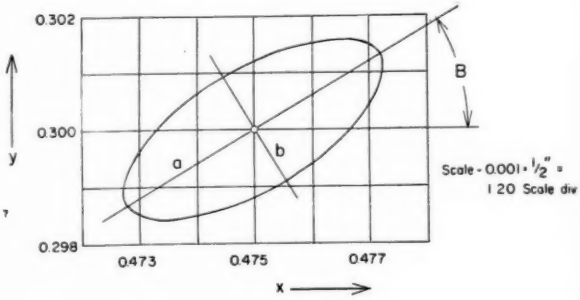
B.) Example of MacAdam Chromaticity Ellipse in Conventional Cartesian Coordinates

Given Data: Central Point Ellipse Constant

$x = 0.475$ $g_{11} = 32 \times 10^4$

$y = 0.300$ $g_{22} = 60.5 \times 10^4$

$2\,g_{12} = -55 \times 10^4$



1 MacAdam Ellipse describes limits of 1 JND from center shown

Calculation of Ellipse

$$\tan 2B = 2\,g_{12}/(g_{11}-g_{22})$$

$B < 90^\circ$ when $2\,g_{12}$ is positive

$B > 90^\circ$ when $2\,g_{12}$ is negative

$$\tan 2B = \frac{-55 \times 10^4}{(32-60.5) \times 10^4} = 1.93$$

$$B = 31^\circ\ 18'$$

$$\frac{1}{a^2} = g_{22} + g_{12} \cot B$$

$$= (60.5 - 27.5 \times 1.64) \times 10^4$$

$$= 15.4 \times 10^4$$

$$a = 0.00255$$

$$\frac{1}{b^2} = g_{11} - g_{12} \cot B$$

$$= (32 - 27.5 \times 1.64) \times 10^4$$

$$= 77.1 \times 10^4$$

$$b = 0.00104$$

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COUNCIL REPORT

209th Meeting • January 24, 1958 • New York, NY

MANAGEMENT of the textile industry has been called on to support AATCC's research and technical program, which will seek in the coming year "not less than $100,000" to give the industry the "coordinated technical information it needs to solve its production and merchandising problems."

President George O Linberg, presiding at the 209th meeting of the AATCC Council January 24, 1958, in the Hotel Statler, New York, read to Council members an open letter he has sent to textile executives asking their support of the Association's Corporate membership campaign. (The full text of the letter appears on page P93 of the February 10th issue of *American Dyestuff Reporter.*)

* * *

Council members approved nominations for appointment of Council Committee chairmen and members for the year 1958.

Harold W Stiegler was named to the position of recording secretary of the Executive Committee on Research, of which Charles W Dorn was confirmed as chairman and Charles A Sylvester was re-appointed vice chairman.

Stephen J Kennedy and George S Wham, Jr, were approved as new members of the ECR by councilors in attendance.

L W Armstrong was named chairman of the Technical Programs Committee, with L B Arnold, Jr, W F Brommelsiek, R H Phillips, A J Andrews, James E Miller and A A Guidotti named members of the Committee.

Thomas J Gillick, Jr was appointed new chairman of the Intersectional Contest Committee, and R E Derby Jr and A H Gaede were approved as new members of this group.

Ernest R Kaswell was appointed new chairman of the National Conventions Committee, with R J Carey named a new member for a term of one year, G P Fulton a new member for two years, and W B Griffin and R B Taylorson new members for four years.

Executive secretary G P Paine was appointed as chairman (pro tem) of the National Publicity Committee, succeeding J A Doyle. Paul B Stam was confirmed as a new member of the Publications Committee.

Other committee appointments were approved by Council as in the previous year.

* * *

A report from the Technical Committee on Research was heard, marking the first time TCR has been placed separately on the Council agenda. Chairman Charles A Sylvester reported that reorganization of AATCC research facilities at Lowell has brought about better liaison between staff members and research committees, resulting in better coordination.

TCR has worked out a standard method of expressing and defining results of AATCC Colorfastness Tests. For evaluating alterations in shade, the "International Geometric Gray Scale" will be used. For evaluating staining or crocking, the "AATCC Chart for Measuring Transference of Color," and the "International Geometric Gray Scale for Evaluating Staining," were selected as interchangeable.

TCR also summarized for Council reports on "A Study of the Variables Encountered in Natural Light Fading" of the Committee on Colorfastness to Light and two new test methods of the Committee on Drycleaning Test Methods, and reported that active research projects were maintained at Lowell during the past year by AATCC Research Committees on Resistance to Abrasion, Colorfastness to Washing, Damage Caused by Retained Chlorine, and Dimensional changes in Textile Fabrics.

Major progress has been made in designing and fabricating a small laboratory fulling mill, and this machine has been used by the Committee on Evaluation of Fulling Agents in its work to develop a test method in this field. The Committee on Dermatitis reports it expects to present for approval in the first quarter of 1958 a document setting forth the principles and procedures for the adequate testing of textile materials for dermatitis potential. The Committee on Antibacterial Agents is ready to present to TCR a tentative test method for the detection of antibacterial property of Fabrics.

Mr Sylvester also gave a summary of other committee activities. Details of these will be contained in the full TCR report, which will be published in a forthcoming issue of *American Dyestuff Reporter.*

* * *

Albert E Sampson reported for the *Colour Index* Marketing Committee that the AATCC had been advised by the Society of Dyers and Colourists that Volume 3 of the *Colour Index* was in the process of being shipped from England. Mr Sampson said that his committee expected copies of this Volume 3 would be delivered to U S subscribers in early March.

* * *

ECR chairman Charles W Dorn reported to Council that research exhibits are being planned for the 1958 Convention (October 30 and 31, November 1, Conrad Hilton Hotel, Chicago, Ill) and that research committees will be polled as to their anticipated intentions, potential exhibits and expenses, so that a proposed budget could be presented to Council.

Mr Dorn also reported that ECR will sponsor a symposium at the forthcoming Convention in Chicago on the subject of improving AATCC research and its service to industry.

ECR has also approved the proposal to establish a system of collecting consumer complaints, and the development of this plan and methods has been assigned to ECR's End Uses

Committee, Mr Dorn said.

The End Uses Committee has also been requested to look into the matter of tests for industrial fabrics, but action on this subject will not develop until investigations on the requirements of industry are completed, Mr Dorn said.

* * *

Perkin Centennial Chairman R W Jacoby reported that the Book of Proceedings of the Centennial had received an Award of Merit during a recent Printing Week competition in New York. He presented to President Linberg and Executive Secretary Paine certificates documenting this award for printing excellence.

* * *

Reporting for the Publicity Committee, J A Doyle urged the Association to consider placing its publicity program on a full-time professional basis, in order to put AATCC in a better competitive position in this field.

He said that "The stature of AATCC in the future, and its importance to industry and the consuming public is related directly to the effort and attention devoted to the Association's publicity and public relations program."

Mr Doyle was commended by the president for his past services as chairman of the National Publicity Committee.

* * *

Regional vice presidents also reported for their areas and sections. E R Kaswell, of the New England Region, made a final report on the 1957 Convention, which attracted 1,730 registrants and was generally adjudged highly successful. Reports and records of this function have been turned over to Elliott Morrill, chairman of the 1958 Convention.

A complete photo record of Convention activities was presented by R J Carey, convention publicity chairman, to Sidney M Edelstein, chairman of the AATCC Archives Committee. Dr Edelstein expressed appreciation for the record, and also indicated his hope that Mr Carey's committee was setting a precedent for future publicity chairmen at conventions.

Elliott Morrill, reporting for the Western Region, said that Convention plans were moving along rapidly, that the 1958 Convention banquet will be held on Friday night, and that Messrs Dorn and Sylvester have been of excellent aid in helping to plan a technical program of high quality. A symposium has been set for Saturday morning, the final convention day. He asked Councilors to report this rough outline to their sections.

H G Smith, of the Southern Region, urged greater research and committee activity in the South, in accord with the number of members in that region.

Weldon G Helmus, Central Atlantic Region vice president and chairman of the Membership and Local Sections Committee, gave a summary of the membership situation. He also asked Council's confirmation of the New York Section's change of name to that of "Metropolitan Section." Council concurred.

* * *

Council approved a resolution offered by Executive Secretary Paine welcoming and extending congratulations and felicitations to the newly formed Argentine Textile Chemists and Colorists Association, and to its members and officers. Mr Paine's office was authorized to make a gift of a copy of the *1957 Technical Manual and Year Book* as a token of friendship.

Upon invitation of the Canadian Association of Textile Chemists and colourists, Council set a meeting for May, 1959, in Montreal, Canada. Next meeting of the Council will be 10 am, Friday, May 23, 1958, in Philadelphia, Pa.

NEW YORK EMPLOYING PRINTERS ASSOCIATION, INC.

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BOARD OF JUDGES

CHAIRMAN

Photo shows the certificate of special merit presented to AATCC by the New York Employing Printers Association, Inc in recognition of the outstanding printing job displayed in the book, "Proceedings of the Perkin Centennial".

The book was displayed along with a case history of its publication by Ogden Printing Co, Inc at the recent 16th Exhibition of Printing, held January 13-16 at the Hotel Commodore, New York, N Y.

Raymond W Jacoby, chairman of the Perkin Centennial Committee, advised Council of the Award at the January meeting held in New York.

1957 Intersectional Contest———

THE STUDY OF LIGHTFASTNESS OF SELECTED DIRECT COLORS ON COTTON, RAYON AND COTTON-RAYON BLENDS*

DELAWARE VALLEY SECTION

COMMITTEE

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Philadelphia Textile Institute
FREDERICK V TRAUT
Globe Dye Works Co

Studies were made of 100%-cotton fabrics using various commercial methods of preparation. The rayon blends and 100%-rayon fabric were prepared using commercial methods suitable for that fabric.

Dyeings were made using selected fast-to-light direct colors, such as considered satisfactory for automotive and upholstery fabric, using methods recommended by the dyestuff manufacturers.

The Committee evaluated all of these dyeings and arrived at conclusions both as to the effect of method of preparation and influence of the fiber on light-fastness.

INTRODUCTION

KNOWLEDGE of the lightfastness properties of cotton-rayon blends would be of great value in the upholstery and automotive fabric field. The need for fabrics with maximum lightfastness is obvious, and the advantages to be gained through a more detailed knowledge of the factors affecting lightfastness are self evident.

In this connection, it has been assumed for some time that the lightfastness properties of direct dyeings on cotton-rayon blends was directly proportional to the amount of rayon, and that an all-rayon fabric would be superior to any blend of cotton and rayon. This assumption has been so strongly fixed in the minds of some dyers that it has become almost axiomatic. No published data to support this assumption could be found, and it was decided to conduct experiments to obtain such data.

Although it was realized that other factors, such as the method of preparation of the fabric, might influence lightfastness, it was decided to make the relation between lightfastness and rayon content the principle field of investigation.

EXPERIMENTAL

FABRICS———The fabrics chosen for this work were commercially available light-weight and plain-weave construction:

100% cotton, 37″, 100 x 58, 4.00 yd/lb carded cotton sheeting;

70% cotton/30% rayon, 37″, 100 x 58, 4.00 yd/lb cotton/rayon blend, warp and filling;

20% cotton/80% rayon, 52″, 47 x 67, 4.00 yd/lb; and

100% rayon, 49½″, 64 x 56, 4.00 yd/lb.

The rayon used in the blends was 1.5-denier bright regular viscose rayon.

PREPARATION———All fabrics were prepared for dyeing by methods and on equipment normally used for each fabric in commercial finishing. In nearly all cases the operations were carried out by commission finishing plants and the fabrics were processed as a part of their daily run. Each fabric was singed and desized and then given further treatment consisting of various combinations and permutations of scouring, bleaching and mercerization. The preparation and composition of the eleven pieces are shown in Table I.

TABLE I
Summary of blend composition and fabric treatment

Piece number	Blend composition Cotton (%)	Rayon (%)	Treatment in addition to singeing and desizing
1	100	0	scoured and bleached
2	100	0	scoured only
3	100	0	mercerized, scoured and bleached
4	100	0	scoured, bleached and mercerized
5	70	30	scoured only
6	70	30	scoured and bleached
7	70	30	scoured, bleached and mercerized
8	20	80	scoured only
9	20	80	scoured and bleached
10	0	100	washed and bleached
11	0	100	washed only

For the all-cotton fabric, the scouring, bleaching and mercerizing as well as the intermediate washings were carried out on continuous ranges, at usual operating speeds and with normal concentrations of chemicals. After being singed on both sides and desized, all the pieces were soured in dilute sulfuric acid before being processed further. The scouring was done with 4% caustic soda in the first section of a Becco-type continuous, 2—J box, scour and bleach range. The bleaching was carried out in the second section of the same range using hydrogen peroxide. The mercerizing was accomplished on a clip tenter range with a double-dip, double-nip padder arrangement, and the cloth entered the range carrying about 60 percent water.

In the case of the 70/30 cotton-rayon blend, the scouring operation was carried out in a kier. Bleaching was done in sodium hypochlorite so-

*Presented by R Stewart Wilkinson on November 15, 1957 at the 36th National Convention, Hotel Statler, Boston, Mass.

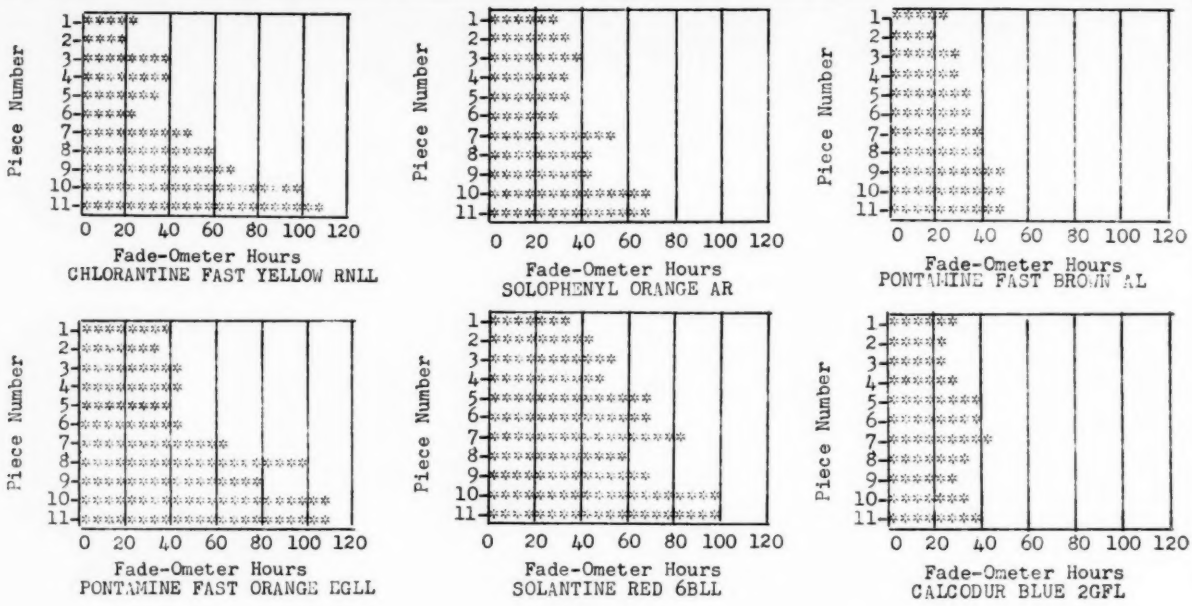

Figure 1

lution. The mercerization was accomplished on a clip tenter range.

The 20/80 cotton-rayon blend was scoured on a jig with caustic soda, soda ash and a synthetic detergent for one hour at 200° F. It was then washed in tetrasodium pyrophosphate and a synthetic detergent on a rope washer.

The all-rayon fabric was given only the wash in tetrasodium pyrophosphate, and synthetic detergent on the rope washer. When done, the bleaching of the 100% rayon and the 20/80 cotton-rayon blend was carried out on the jig with hydrogen peroxide.

DYEING——Dyeings on all eleven pieces were made in the laboratories of the companies supplying the dyes. The concentrations of dye on the various peices were adjusted to approximate depth of shade obtained in piece No. 1 (100% cotton, scoured and bleached) with 0.75% dye.

The method used was essentially that prescribed by the manufacturers of the individual dyes and regarded as standard procedure by most laboratories. The dye was dissolved in a sufficient volume of hot water and added to the dyebath set at 90° to 100° F. The fabric was introduced, and the temperature of the dyebath was raised to 200°—205° F over a 30-minute interval. From this point on, the procedures for the various blends differ slightly in conformity with practice. The fabrics were held in the dyebath containing 10% sodium chloride for one hour at 200°—205° F.

The salt was added in two portions and the fabric was removed from the hot bath, given a rinse in cold, 10% salt solution and dried. In all dyeings the liquor-to-cloth ratio was 30/1.

In order to determine whether the lightfastness was influenced by penetration, several dyeings were made in which the color was applied on a laboratory pad. The wet pick-up was approximately 70% and the concentration of the dye solution was adjusted to give depths of shade approximately equal to those obtained from a long bath.

TESTING——The lightfastness of all the dyeings was determined by the Standard Test Method 16A-56 of the AATCC, "Colorfastness to Light, A. Carbon-Arc Lamp Test." Test specimens made with the same dye were exposed simultaneously for periods of 20, 40, 60, 80 and 120 hours. Since all the results are relative, no attempt was made to correct the exposures to standard Fade-Ometer hours.

The exposed specimens were graded by members of the Committee. The exact number of hours of exposure required to produce "just appreciable fading" was estimated visually.

DISCUSSION

The dyes used in this investigation were chosen because of their inherent good lightfastness. They are employed extensively in dyeing automotive and upholstery fabrics and represent a good cross section of the colors available. Since several of the dyes are not listed in the new *Colour Index* and some are so new that new *CI* numbers have not been assigned, all dyes are listed under their trade names. The use of such trade names does not constitute endorsement of these products by the Delaware Valley Section or the American Association of Textile Chemists and Colorists.

The fabrics used were chosen to represent commercially available, cotton-rayon blends in which the rayon content varied from 0% to 100%. It was realized early in the study that construction, yarn twist, tightness of weave and fiber properties might well influence lightfastness significantly. For this reason, a preliminary study was made using cotton yarn, rayon yarn, and yarns spun from cotton-rayon blends. It was found that the ratio of cotton to rayon did have a large effect upon the lightfastness, outweighing any possible influence of the other factors.

The use of more than four ratios of cotton to rayon would have been desirable, and the lack of a blend with a ratio of 50/50 is perhaps unfortunate. Yet the effect of the ratio can be readily seen from the data in Figure 1 and Table II. Although there are some discrepancies, these are usually within the limits of experimental error, and in general the lightfastness of the dyed fabrics is directly proportional to the amount of rayon in the blend.

The effect of the rayon content on the average lightfastness is illustrated in Figure 2. Here lightfastness values are relative with the rating of Piece Number 1 being taken as unity for each dye. The 12 values for each of the four scoured and bleached fabrics (Pieces 1, 6, 9 and 10) were then averaged, the data were plotted and the

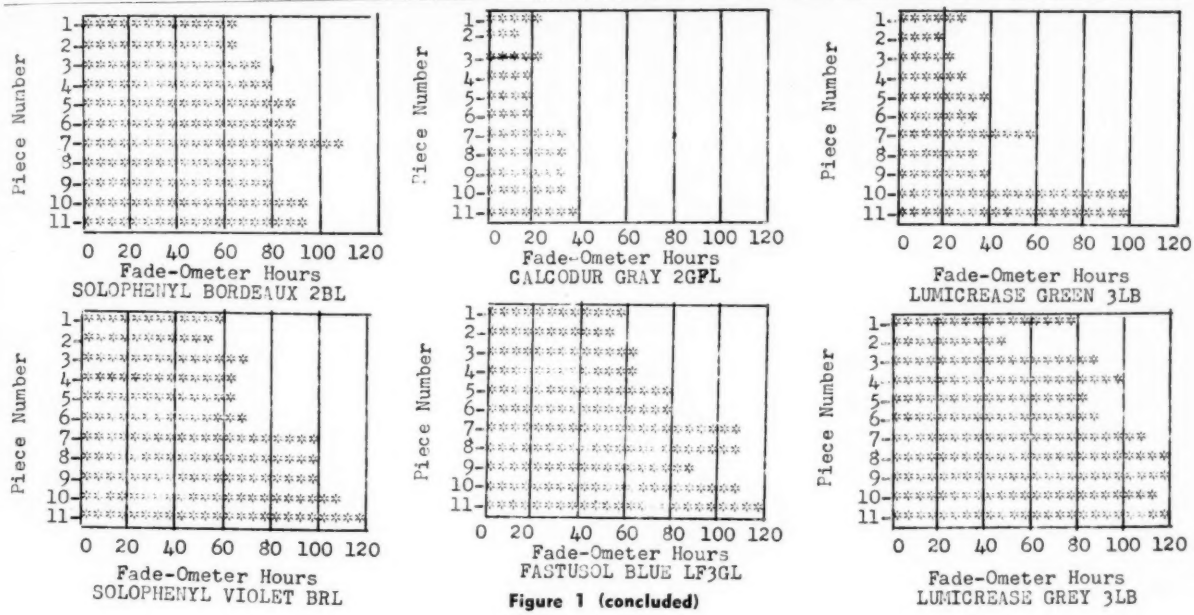

Figure 1 (concluded)

TABLE II
Lightfastness in Fade-Ometer hours for twelve dyes

	New CI Number	Piece Number 1	2	3	4	5	6	7	8	9	10	11
Chlorantine Fast Yellow RNLL	29025	25	20	40	40	35	25	50	60	70	100	110
Pontamine Fast Orange EGLL	40215	40	35	45	45	40	45	65	100	80	110	110
Solophenyl Orange AR	—	30	35	40	35	35	30	55	45	45	70	70
Solantine Red 6BLL	29065	35	45	55	50	70	70	85	60	70	100	100
Pontamine Fast Brown AL	—	25	20	30	30	35	35	40	40	50	50	50
Calcodur Blue 2GFL	—	30	25	25	30	40	40	45	35	30	35	40
Solophenyl Bordeaux 2BL	—	65	65	75	80	90	90	110	80	80	95	95
Solophenyl Violet BRL	25410	60	55	70	65	65	70	100	100	100	110	120
Calcodur Gray 2GFL	—	25	15	25	20	20	20	35	35	25	35	40
Fastusol Blue LF3GL	—	60	55	65	65	80	80	110	110	90	110	120
Lumicrease Green 3LB	—	30	20	25	30	40	35	60	35	40	100	100
Lumicrease Grey 3LB	—	80	50	90	100	85	95	110	120	120	115	120

best straight line drawn through the four points. Similar treatment of the data for the pieces that were scoured only (Pieces 2, 5, 8 and 11) produced a line that nearly coincides with the one in Figure 2.

Differences in methods of preparation produced at the most only slight differences in lightfastness. In the case of mercerization, where it was possible to compare 36 pairs—one mercerized and one not mercerized, in 29 pairs the mercerized sample was better, in three it was worse and in four there was no difference. For the 48 pairs of bleached and unbleached samples, the bleached sample was better in 16, equal in 19, and worse in 13.

CONCLUSIONS

From the results presented, the following conclusions can be drawn:

1) The lightfastness of cotton-rayon blends dyed with direct dyes is directly proportional to the amount of rayon in the blend.

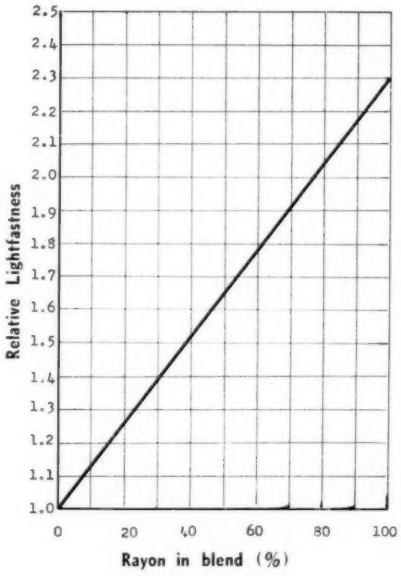

Figure 2
Effect of Rayon Content on Lightfastness
Average Values

2) Bleaching prior to dyeing is not a significant factor in the lightfastness of direct-dyed fabrics. Substantially the same results were obtained in each case on bleached and unbleached fabrics.

3) Penetration of dye is not a factor in lightfastness since the same results were obtained whether the dye was applied by padding or from a long bath.

4) Mercerization before dyeing improves the lightfastness.

SUMMARY

Laboratory data has been presented which shows that, in accordance with general assumption, the lightfastness of cotton-rayon blends does improve directly with the percentage of rayon.

ACKNOWLEDGMENTS

The Committee wishes to thank the following concerns for their help in the preparation of this paper:—

American Cyanamid Co
American Viscose Corp
Joseph Bancroft & Sons Co
Ciba Co, Inc
E I duPont de Nemours & Co, Inc
Frankford Woolen Co
Geigy Chemical Corp
Globe Dye Works Co
Hart Products Corp
Hellwig Dyeing Corp
Millville Mfg Co
National Aniline Div
Para-Chem, Inc
Philadelphia Textile Institute
Scholler Brothers, Inc

Research Committee Report———

CHLOROPHYLL CONTAMINATION OF WOOL AND ITS EFFECT ON THE LIGHTFASTNESS OF DYED SHADES

CONTINUOUS WOOL SCOURING PROCESSES SUBCOMMITTEE
TECHNICAL COMMITTEE ON RESEARCH

INTRODUCTION

LATE in 1953, the attention of the Continuous Wool Scouring Processes Subcommittee was drawn to a problem of extremely poor lightfastness, which occurred from time to time in many woolen mills without apparent cause. The important features of this problem were:

1) Light stock-dyed shades were affected most noticeably—commonly ivory, oyster, pastel blues and pinks, light browns and grays, and sometimes pale greens. Yarn-dyed or piece-dyed shades rarely exhibited poor lightfastness.

2) The direction of fade was always toward the red, ie, the shade reddened as a result of the fading.

3) The amount of light exposure required for the fading was very little. For example, the sides of roving spools facing the windows in a card room, but not exposed to sunlight, would fade in the course of an eight-hour day. The same roving when exposed in a Fade-Ometer would show the same change in 30 to 45 minutes. The top of a skein of the yarn left on a desk over a weekend with only natural outdoor light coming in the window would be faded by the following Monday morning.

4) The dyes were always above suspicion with respect to lightfastness. Some dyes commonly used to dye the shades in question were Acid Yellow 11 (*CI* 18820), Acid Green 25 (*CI* 61570), Acid Blue 41 (*CI* 62130), Acid Red 37 (*CI* 17045), and more recently several of the neutral-dyeing metallized dyes. The same dyes, when applied on skeins in the laboratory, failed to show the rapid fading toward the violet. Furthermore, some undyed wool lots showed a tendency to "bleach" under similar conditions.

The hypothesis was therefore formulated, that some variable property of the wool was involved. The members of the Subcommittee experimented individually to determine the precise cause of the rapid "red fade" and, if possible, a means of preventing it.

COMMITTEE
EMIL C HANSEN, *chairman*
General Aniline & Film Corp
JACKSON BAUER
Collins & Aikman Corp
JOSEPH J BENISCHECK
Philadelphia Wool Scouring & Carbonizing
EDMUND A LEONARD
General Foods Corp
HERBERT J WOLLNER
American Conditioning House, Inc

Since many unrelated steps of a trial-and-error nature were taken by several persons and later organized into a unified analysis, the findings do not make a logical pattern if presented chronologically. The following summary therefore relates not the order in which the findings were made, but rather a successively broader understanding through which the problem was solved.

DISCUSSION

CAUSES OF THE RAPID "RED FADE"———As noted above, a property of the wool which varied from lot to lot or perhaps with wool type was suspected of being the cause of the elusive problem. Throughout the investigation, the effect was hampered by the difficulty of getting material which exhibited the phenomenon. The problem would not appear for months at a time and then, within a few months, would occur in a half-dozen to a dozen lots. Therefore, in the early stages of this work, the unpredictability of the phenomenon caused considerable delay in its analysis. However, when sufficient quantities of several problem lots were assembled, chemical and spectrophotometric attacks were launched.

The first breakthrough came from a series of extractions made on specimens of problem lots. They showed a) that foreign material was present, which could be removed under certain conditions; b) that the removal of this foreign material produced the same color change in the red direction as the fading; and c) that once the foreign material was removed, the dyed material would not exhibit the rapid "red fade". In the extractions, very little other than oil and some particulate dirt was removed by water, benzene, xylene, carbon tetrachloride, trichloroethylene, or perchloroethylene. A yellow-green material was readily removed by extraction with ethyl alcohol or certain aliphatic naphtha fractions and removed in large part by thorough scouring with soap or synthetic detergent. This removal reddened the color of the wool and ended its tendency toward further "red fade". Thus the "red fade" phenomenon was determined to be caused by a "fadeable dirt" contamination.

A careful study was then made of the yellow-green alcohol extract and of the wool reddened by the extraction. When particulate matter was removed from the extract by filtration, the filtrate resembled in appearance the color standards used to estimate the chlorine content of chlorinated water. When exposed to strong daylight on a window sill in a colorless bottle, the yellow-green color in the solution faded almost completely within a few hours, verifying that this was the fugitive element in the wool. Recording spectrophotometer curves were then made of:

A) the original wool color (in this case a white wool blend);

B) the "reddened" wool color resulting from alcohol extractions and from short exposure in a Fade-Ometer;

C) the freshly-prepared alcohol extract.

The relationships among these three color curves are shown in Figure 1. Two important conclusions can be noted immediately:

1) The faded or extracted wool color is "reddened" not by addition of redness but by removal of yellow-green components.

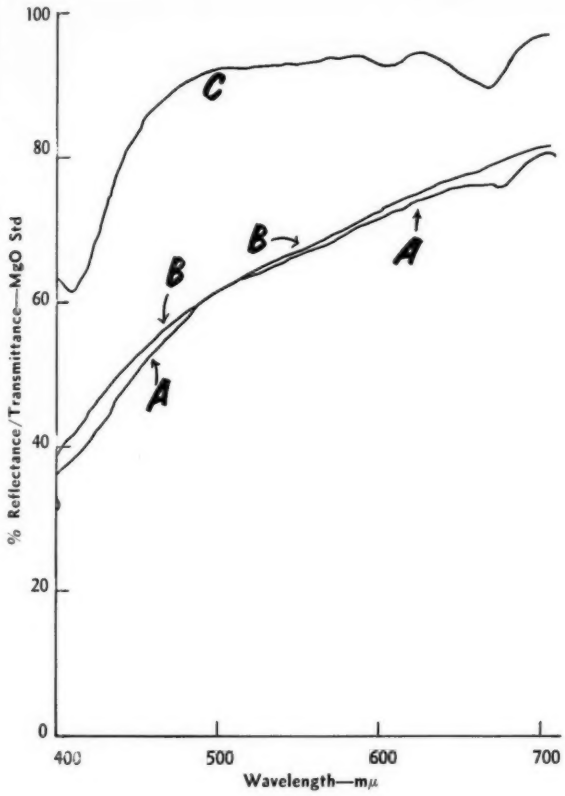

Figure 1
Relation of wool "red fade" to color of alcohol extract
A—Original wool sample reflectance
B—Faded or extracted wool reflectance
C—Alcohol extract transmission

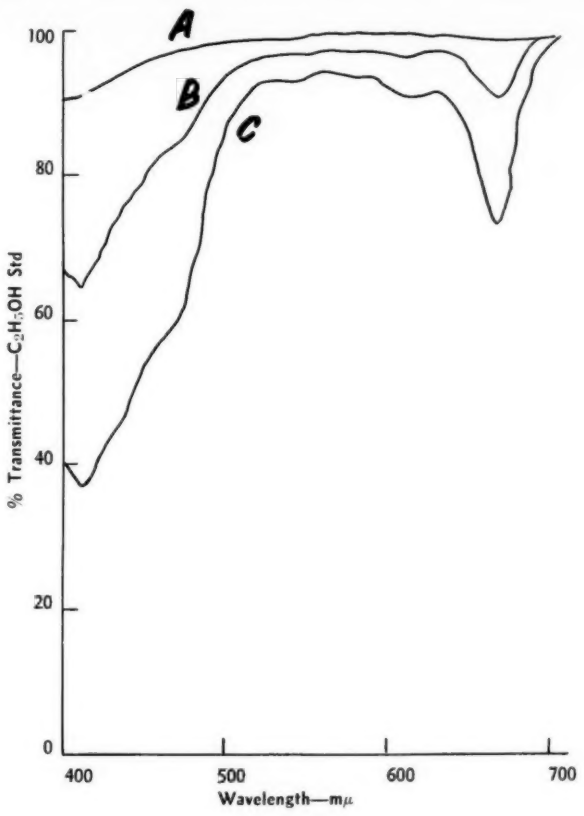

Figure 2
Alcohol extracts of three scoured wool lots showing degrees of contamination
A—Slight contamination
B—Troublesome contamination
C—Severe contamination

2) The absorption curve of the alcohol extract has dips whose removal correspond to the color change of the wool from "as is" to faded". The dip in the original wool curve at 660 mμ, which is foreign to clean wool, corresponds with the dip in the extract's color curve at that wavelength.

These findings then required verification on a number of wool lots, together with standardization of the alcohol-extraction technique. A long series of tests on many lots of wool stock and yarn, both dyed and undyed, revealed that the yellow-green alcohol-extractable material was detectable in almost every lot, but present in a significant quantity only in those lots which exhibited noticeable "red fade".

The simplest extraction procedure for routine analysis was a modification of the rapid extraction procedure in the AATCC Standard Test Method 64-52 in which alcohol was substituted for carbon tetrachloride. Additional steps provide for filtration and spectrophotometric measurement of the extract. When finally developed, the extraction procedure was as described in the Appendix.

Applying this test to the abovementioned lots, the severity of fadeable dirt contamination could be determined by relating the visual "red fade" effect to the absorption of the extract at the node of the spectrophotometric curve near 420 mμ. The distinctions indicated by experience and shown in Figure 2 are:

A) If the transmission at 420 mμ is above 90%, the contamination is slight and not troublesome.

B) If the transmission at 420 mμ is below 90% but not below 60%, the contamination is troublesome but can be removed by scouring the wool in a wool washer, if it is in stock form, or in a continuous yarn washer, if it is in skein form.

C) If the transmission at 420 mμ is below 60%, the contamination is severe and cannot be removed generally in a single washing as described in (B) above. Discussion of removal at this point is getting a little ahead of the story, and much more will be said about it below, but it is necessary to mention it here to clarify the distinctions in severity.

A final verification was made by comparing the transmissions of the alcohol extract at 420 mμ against the reflectances of 27 white wool lots at the same wavelength after 2 hours exposure in a Fade-Ometer. The reflectance increases were inversely proportional to the transmission of the alcohol extract, ie, the lower the transmission at 420 mμ, the greater the reflectance increase on fading. To visualize this statement, note Figure 3 in comparison with Figure 1. The latter has an extract transmission of 61.5% at 410 mμ, and the yarn reflectance increases about 4% on ex-

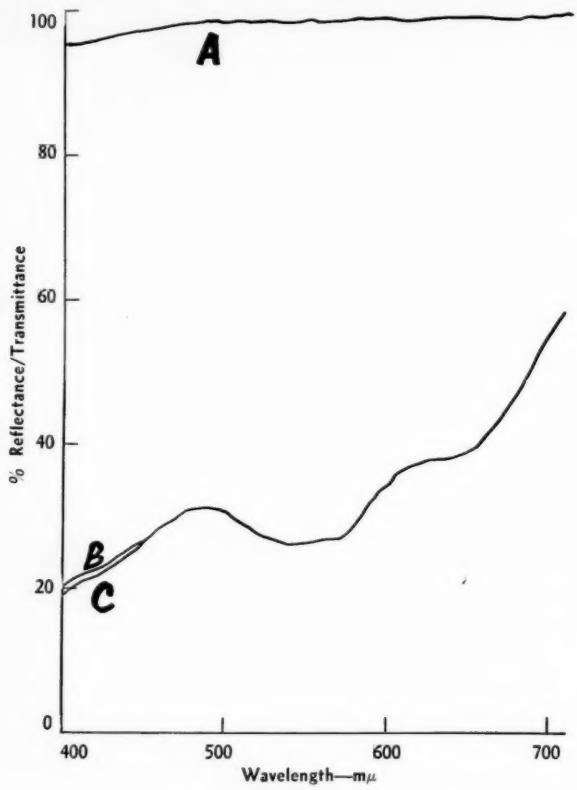

Figure 3
Relation of slight "red fade" to slight yellow-green contamination
A—Alcohol extract
B—Faded two hours
C—Dyed yarn

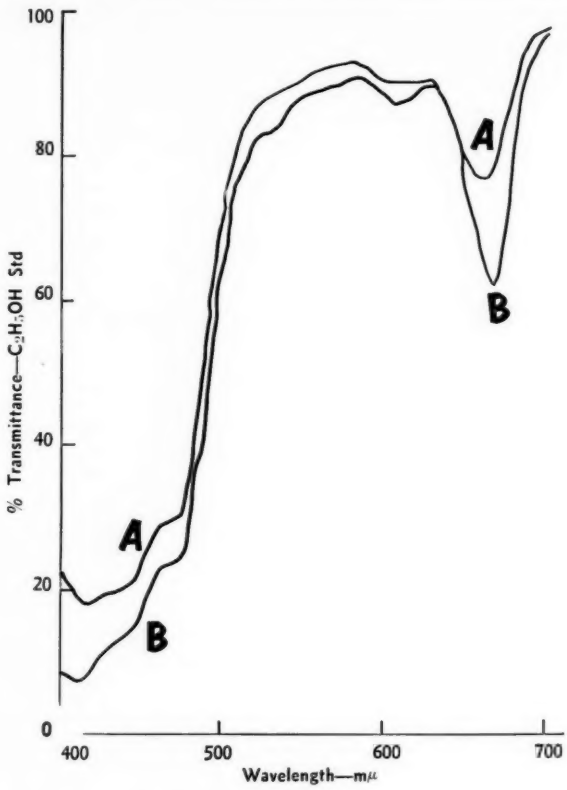

Figure 4
Comparison of dung locks extract with heavy fadeable dirt combination
A—dung locks extract, diluted to ¼ std conc
B—extract from heavily contaminated lot of 2nd White India, 36s

posure in a Fade-Ometer for 2 hours. By contrast in Figure 3, the contamination is slight (95.5% at 410 mμ) and the yarn reflectance increases less than 1% on fading.

Thus the general nature of the "red fade" phenomenon was established, and a means of its detection was found. Two major problems remained; viz, the identity of the green coloring material in the alcohol extract, and its control. While these were attacked concurrently, specific causes will be discussed first.

The lots in which heavy contamination was indicated by the alcohol-extract test were studied chemically, microscopically, and historically. Chemical tests were not informative, since the lots fell in normal ranges of fiber pH and ash, acid or alkali, and grease contents. No relation could be established between grease content and alcohol extract transmission. Spinning oils were eliminated as sources of the yellow-green contamination as were dyeing acids and salts and the dyes themselves. The key was found by microscopic and historical examinations.

A reinvestigation of the most heavily contaminated lots in a carpet mill revealed that several of them were made from wool blends which contained significant percentages of cotts, clothings, and other "dungy" wools. The miscroscopic examinations revealed small flecks of dark organic matter and "dunglocks" in the wool stock. It was quickly determined that these flecks and dunglocks would release an intense yellow-green color when dropped into ethyl alcohol, and that this color was very fugitive to light. When the dung extract was suitably diluted and filtered, the spectrophotometric curve matched those of heavily contaminated wools. Figure 4 shows the alcohol-extract transmission curves of dunglocks taken from a wool lot, diluted to one-fourth the standard concentration, and the extract from a scoured lot of Second White India wool (Grade 36/s.). With this knowledge, the hypotheses was formulated that dung contamination is the carrier of the yellow-green color, which is probably chlorophyll from sheep forage.

Samples of freshly cut grass were obtained and extracted with alcohol. The resultant yellow-green solution was measured in the spectrophotometer and gave the transmission curve shown in Figure 5. While the general shape is similar to those of the dunglocks and contaminated wools, the relative intensities of the two nodes differ, and the lowest is nearer 432 mμ than 420. The alkalinity of scoured wool was considered, and samples of grass were scoured like raw wool before extraction. Figure 6 shows the transmission curve for the scoured grass. The lowest node is displaced toward 420 mμ. As for the relative intensity of the nodes at 420 and 664 mμ, a referral to Karrer's "Organic Chemistry" (*1*) revealed that the coloring matter of green vegetation is not homogeneous but con-

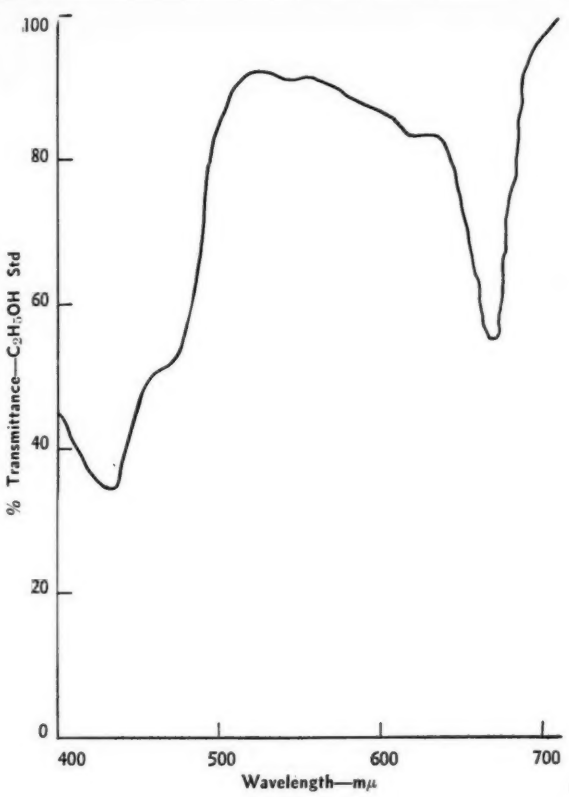

Figure 5
Alcohol extract of grass

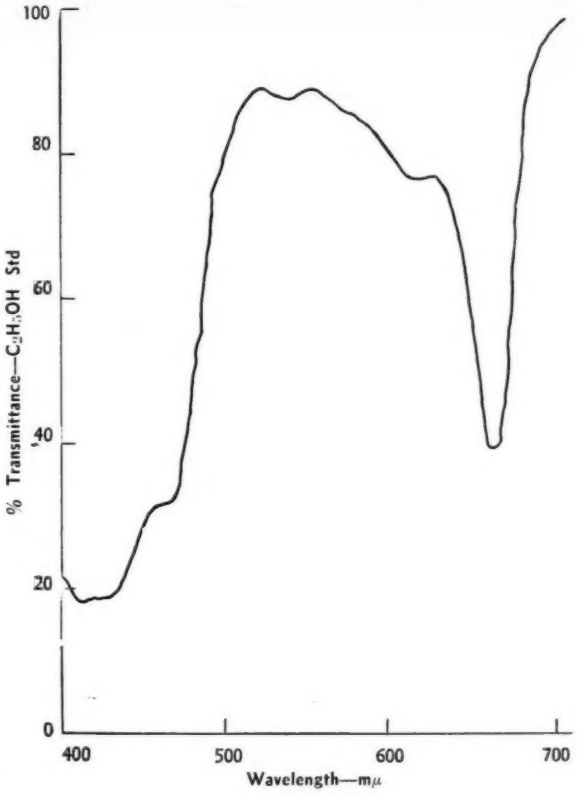

Figure 6
Alcohol extract of alkaline scoured grass

sists of mixtures of blue-green and yellow-green chlorophyllins. It is reasonable to assume, therefore, that the relative intensities of the nodes at 420 and 644 mμ would vary with the type of vegetation involved.

The question was raised as to whether chlorophyll present in sheep forage would survive the animal's digestive processes without chemical change and persist in the dung. An affirmative answer was obtained (*2*) from M W Taylor, head of Department of Agricultural Biochemistry, and G W Vander Noot, chairman of the Department of Animal Husbandry at Rutgers University. They stated:

"A method which is being used a fair amount now to determine digestability of forages is to measure the ratio of nitrogen to chlorophyll pigments in the forages and in the feces. The chlorophyll pigments are supposed not to be changed and to have remaining a constant value to which the nitrogen content can be compared. You might care to refer to a couple of articles on this subject in the *Journal of Agricultural and Food Chemistry*. The first is in Vol 1, page 318 (1953) with the title: 'Pigments Involved in the Chromogen(s) Ratio Method'. The second article is in Vol 2, page 1331 (1954) issue of the same journal and is entitled: 'Use of Copper derivatives of Chlorophylls in Ratio Method for Estimating Digestibility of Forages'.

"These articles indicate very clearly that there are plenty of chlorophyll pigments present".

It was later shown that chlorophyll contamination can arise from some source other than dung in the raw wool which is not completely removed by scouring. The Subcommittee is indebted to Henry Millson and Elmer Glaeser of the Dyestuff Division of American Cyanamid Co for a study (*3*) demonstrating that chorophyll-bearing algae in dyehouse water supplies can cause the same effects as chlorophyll from dung. They reported the following experiment:—

"Back in October 1953, when the fadeable dirt problem was most acute, there was also a rather severe drought in this part of the country. Natural rivers and creeks were low and many ponds and creeks had large amounts of algae and other chlorophyll-forming vegetation covering their surface, and may well have been contaminated with vegetation which could contribute chlorophyll.

"We obtained water and algae from such a pond on Canal Road in South Bound Brook (NJ) and used an extract from this material for treating various carpet yarns to determine the effect on shade of the presence of such contamination.

"Water and algae were collected and allowed to stand for about one week. A portion of the algae was then ground in a mortar and mixed with water to form a greenish suspension. Forty milliliters of this suspension was made up to 400 ml by the addition of 360 ml of water. Yarns were treated by immersion in 400 ml of the chlorophyll suspension for 20 minutes at 125°F. Yarn was extracted and dried without rinsing. Visual comparison of treated and untreated yarns showed the chlorophyll-treated wool to be considerably yellower in shade.

"When the chlorophyll suspen-

sion was added to the scour bath (Deceresol NI and soda ash) the wool became yellower in shade. This would indicate that the presence of chlorophyll in a scour bath can be detrimental and be responsible at least in part for yellowness of fadeable dirt".

Vegetable matter in wool is also a possible source of chlorophyll contamination, as indicated by Subcommittee member J Bauer, who made colorimetric measurements on the alcohol extracts of burrs and shives from burry wool (*4*). He reported an experiment conducted in 1955:—

"In accordance with our discussion at the recent meeting of the Committee on Continuous Wool Scouring, we have obtained some samples of a Domestic 56/58's wool in two different forms: in the grease before scouring and after scouring.

"Observation of the vegetable matter present in this wool showed that there was some which was predominantly yellow in color while others were predominantly green. Accordingly, we picked out some of each type vegetable matter from the grease wool before scouring and also from the scoured wool. These pieces of vegetable matter were cut into small portions to suitably fit into the cup and plunger arrangement as used in the AATCC #64-52 test for extraction. Five grams of the vegetable matter were used for the alcohol extraction in each case and otherwise the instructions were followed as given in the specifications for testing the alcohol extract of yellow-green color in wool which was used in previous tests. All samples of wool as well as vegetable matter were kept away from the light as far as possible. Duplicate extractions were run and these extracts were combined in order to get readings on the Klett-Summerson colorimeter. Readings were taken with the red filter having the meter setting at 0 with alcohol used as a blank."

The results were as shown in Table I.

TABLE I

Color of vegetable matter	*Vegetable matter from grease wool*	*Vegetable matter from scoured wool*
Yellow	27.0	21.0
Green	39.0	52.0

At this point, the causes of "red fade" were sufficiently well identified to permit a summarization as follows:

1) Red fade is caused by the contamination of wool with a specific type of foreign matter which is yellow-green in color and fugitive to light—thus, a fadeable dirt—whose removal visually reddens a dyed shade by loss of yellow and green components in the total color.

2) The yellow-green agent is indicated by spectrophotometric tests specifically to consist of chlorophyll pigments.

3) Chlorophyll contamination of wool can arise from sheep dung and vegetable matter which are naturally associated with many commercial wool types, or from mill water supplies which contain chorophyll-bearing microorganisms.

CONTROL OF FADEABLE DIRT ——When armed with knowledge of causes and means of identifying fadeable dirt, the Subcommittee members who worked in woolen mills were better able to act with effective planning on the problems of manufacturing control.

Identification of chlorophyll-contaminated lots was the easier problem. It was found very practical at one mill to use core borings sampled from lots of raw stock received and laboratory scoured to determine clean fiber content. The core borings were taken according to ASTM Designation D1060, which provided that they would be reasonably representative of the lot in question. They were then scoured according to ASTM Designation D584, which resulted in a clean wool reasonably close to commercially dusted and scoured stock. By simply sampling and scouring duplicate core borings, we were able to make available additional samples for alcohol extraction and spectrophotometric transmission measurement on the extract. Although additional work was involved in the extra sampling, scouring, and testing, it was not necessary to conduct this procedure on all the wool imports and lots received at the plant, but rather only on lots which would be major components in blends used to stock dye light shades. Transmittance of the alcohol extract at 420 mμ was established as the measure of severity. (Note again Figure 2 and associated text).

In addition to testing selected lots of raw wool, it was found advantageous and inexpensive to make routine daily checks on scoured wool from the washers. Sample fiber was available from the regular control tests for residual grease, and merely by adding alcohol extraction and spectrophotometer measurement it was possible to set up control charts on the wool blends and to forewarn the dyehouse of rounds which were running high in contamination and would be dangerous for certain light shades.

All this was useful information which reduced the surprise element in the appearance of "red fade"; but positive procedures for control would be much more desirable, particularly if they could be used at low cost and high speed, because heavily contaminated lots had a way of arriving in groups. It was little consolation to know that all lots of a given type in the plant were "high-chlorophyll" lots if they had to be used and corrective measures were not available. The Subcommittee members experimented individually in their respective laboratories to screen processes that they had reason to believe might remove or destroy chlorophyll contamination. Several pounds of homogeneous samples from two badly contaminated wool lots were sent to each member for his experimentation: one was the 2nd White India referred to in Figure 4, and the other was a lot of domestic dungy wool known as Texas Tags. Some of the test results from the laboratory studies were:—

1) Scouring the raw stock at different temperatures (ranging from 125° to 212°F) and varying from neutral to strongly alkaline produced no significant differences in final alcohol-extract transmittance. Nonionic synthetic detergent scouring showed a slight advantage over soap, but was not by any means a cure for severe contamination.

2) Peroxide bleaching, hydrosulfite stripping, and sulfoxylate formaldehyde stripping were tested as post-scouring steps. Bleaching was totally ineffective, while stripping gave good but nonuniform removal. A series of side experiments was done on stripping natural color from grass and straw with good success, and it was indicated that stripping reactions could be developed to decolorize fadeable dirt in wool.

3) Dry heat, water boiling, soaking in solutions of sequestering agents, hot and cold acid solutions all were totally ineffective.

4) An interesting experiment shed considerable light on mechanism of chlorophyll affinity for wool. Concentrated dung locks were accumulated and about a pound extracted with ½ gallon of alcohol. The extract was filtered to yield a clear bright green solution almost the color of creme de menthe. Ten

cc of this solution was added to half-liter beakers containing an alkaline scouring solution, a neutral scouring solution, a "neutral" dyebath, and an acid dyebath. Upon dilution of the alcohol in these solutions, the dissolved chlorophyll pigments precipitated to give a dilute milky dispersion. Ten g of undyed wool, carefully extracted to eliminate detectable fadeable dirt, was entered into each bath and soaked at 140°F for ½ hour. The wool specimens were then removed, rinsed, dried, observed for color differences against untreated controls, alcohol extracted, and exposed in the Fade-Ometer for one hour. The results were that, in both scouring solutions, the chlorophyll remained in the liquid phase; in the neutral dyebath, some attachment to the wool took place; while in the acid dyebath at pH 4.0, the chlorophyll exhausted almost quantitatively on the fiber, leaving a clear, colorless solution and a definite light green "dyed" shade on the wool, which faded completely in the short Fade-Ometer exposure.

5) Carbonizing was found to be effective, and was especially good when followed with sodium bisulfite reduction. Several principles for control were offered by these experiments combined with other available knowledge, and these led to the following plant-scale tests:

a) Chlorophyll associated with the wool as dung or vegetable matter contamination is particulate and removal might be materially assisted by good mechanical processing before scouring, such as thorough dusting. Eight bales of the 2nd White India mentioned above were tested for chlorophyll contamination after one, two, and three passes through a Proctor and Schwartz opening unit followed by recovery through a single-drum ceiling condenser. Each pass removed more fadeable dirt, but only about half as much as the previous pass. When each pass through the opener was followed by scouring and drying, however, the effectiveness per pass was almost constant, and after three passes the alcohol extract of this wool was over 90% transmittance at 420 mμ.

After further trials with this and other lots of varying contamination, a plant procedure was set up in one mill as shown in Table II.

b) Since the chlorophyll is not substantive to wool in alkaline solutions, but is in acid solutions, it should be removed to the greatest possible extent before dyeing.

TABLE II

Lots showing alcohol extract transmittance	Open and prescour the lot
Between 60% and 70% at 420 mμ	once
Between 50% and 60% at 420 mμ	twice
Below 50%	three times

Scouring procedure modifications showed improvement when the amount of fresh rinse water used was increased and the rinse bowls dumped and refilled with fresh water twice a shift instead of once a shift during the prescouring of contaminated lots or the scouring of marginally contaminated blends.

c) Several severely contaminated lots were commercially carbonized and post-treated with sodium bisulfite with good results.

CONCLUSION

This work shows that chlorophyll contamination will cause wool dyed in pastel shades to rapidly loose greenness and assume a reddish cast (red fade). A method to determine the presence of troublesome amounts of chlorophyll in the raw wool has been developed and a procedure for removing most of the light-fugitive chlorophyll from the wool during the initial processing steps has been outlined.

Further work is indicated on this problem as there is a possiblility that bile may be a contributing factor in "red fade". Bile generally contains two pigments both of which are formed in the liver from the decomposition of hemaglobine. One is the greenish biliverdine, which probably predominates in sheep bile, and the other is the yellowsh-brown bilirubin.

ACKNOWLEDGMENTS

The Subcommittee acknowledges with thanks the contributions of the several persons other than members who have contributed to this work, including:—

Henry Millson and Elmer Glaeser of American Cyanamid Co for their analytical work and investigation of plant water supplies as sources of chlorophyll contamination;

Carmelo De Angelis, pathologist at St John's Riverside Hospital in Yonkers, New York, for the use of his library and helpful guidance on the chemistry of digestion in herbivores;

M W Taylor and G W Van der Noot of Rutgers University for their advice on the persistence of chlorophyll in sheep forages;

and the several former members of the Wool Scouring Processes Subcommittee who contributed during their tenure and have transferred their activities to other lines of endeavor:

David G David
Joseph H Binns
F J de Maria
Harry Morgan
R E Wolfrom

REFERENCES

(1) Karrer, "Organic Chemistry" p 721: Nordeman (1938).
(2) Private correspondence, G W Van der Noot to E Leonard (2/10/55).
(3) Millson & Glaeser, "Fadeable Dirt Investigation" unpublished report on Cyanamid Inquiry No. 78984 (7/22/54).
(4) Private correspondence, J Bauer to E Leonard (6/30/55).

APPENDIX

Specification for testing alcohol extract of yellow-green color in wool

I. SCOPE

This specification outlines the procedure for extracting and measuring the alcohol-soluble yellow-green coloring matter contaminating wool.

II. EQUIPMENT & MATERIALS

A) *Equipment*
1) Greaseometer brass cups, plungers, and graduate cylinder to read 13 ml and 29 ml.
2) Torsion balance for weighing 5.00 ± .01 gram samples of wool.
3) General Electric recording spectrophotometer.
4) Four-ounce glass bottle with two-hole rubber stopper and funnel.

B) *Materials*
1) USP 95% ethyl alcohol

III. PROCEDURE

A) For each sample weigh out three air dry 5-gram samples on the laboratory torsion balance to the nearest 0.01 gram.

B) Extract two samples at a time (6 specimens) in the six-cup circular Greaseometer jig provided for grease tests, using the following procedure:
1) Place the wool specimens in the brass cups.
2) Add 29 ml of USP 95% ethyl alcohol to each brass cup.
3) Work the circular plunger jig in a rocking circular motion for 25 revolutions, avoiding any loss of alcohol from the cups through splashing. One revolution per one or two seconds is the appropriate speed for working the alcohol solvent

through the wool specimens. Transfer the extract from each specimen into the special 13-ml aliquot graduate by squeezing the alcohol out of the wool specimen using the plunger and brass cup.

5) Combine the 13-ml aliquot portions from the three specimens for a given sample and filter through S & S No. 589 filter paper into a four ounce glass bottle. *Stopper bottle and keep in dark until ready for spectrophotometer measurement. Measure extract color the same day the extract is obtained!*

C) Measure the transmittance curve using USP 95% ethyl alcohol for the blank.

◆—◆

NOTE

We regret the omission of J V Killheffer, E I duPont de Nemours & Co, Inc, from the list of Research Committee members published in conjunction with the Piedmont Section's 1957 Intersectional Contest paper, "Relation of the Effect of Resins on Light Fading and the Tendering Action of Photosensitive Vat Dyes", which appeared on page P39 of the January 27, 1958 issue.

AATCC SUBJECT AND SPEAKERS BUREAU

The Subject and Speakers Bureau Committee of AATCC is now soliciting additional papers to augment its current file of available subjects and speakers.

Quarterly, a listing of these subjects is circulated to all local sections of AATCC, with an invitation to local section program chairmen to contact the speakers for section meetings. This file now consists of more than 50 subjects, and many sections have benefited from this service.

Those who have papers ready or in the process of preparation are invited to submit an abstract of the paper to the chairman or other members of the Committee.

Papers of a general nature, as well as technical papers, will be acceptable.

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Activities of the Local Sections

Delaware Valley

THE Delaware Valley Section, AATCC, in conjunction with the Delaware Valley Tanners' Club and the Philadelphia Textile Institute, has announced the following list of speakers for its forthcoming series of lectures on the subject "Colloids and Emulsions":

March 3 and 10—"Basic Principles"—Mason Hayek, E I duPont de Nemours & Co, Inc

March 17—"Practical Emulsions"—Paul Becher, Atlas Powder Co, Inc

March 24—"Industrial Colloids"—Hillary Robinette, Robinette Research Laboratories

March 31—"Colloids in Dyeing"—Emery I Valko, Lowell Technological Institute

April 14—"Colloids in Finishing"—Albert C Nuessle, Rohm & Haas Co

The sessions will be held at Philadelphia Textile Institute from 7:30 to 9:30 pm on the dates indicated. Further information and applications may be obtained from the Educational Committee, Delaware Valley Section, AATCC, P O Box 5025, Philadelphia 11, Pa.

Rhode Island

FERNAND Schlaeppi, chief technician, Ciba Co, Inc, spoke on the subject "Some Principles of Fabric Reactive Dyes and Practical Experience in Their Application" at the January 30th meeting of the Rhode Island Section.

The meeting, held at Johnson's Hummocks Grill, Providence, RI, attracted approximately 160 members and guests, including George O Linberg, AATCC president.

Northern New England

THE Northern New England Section has announced the following schedule of meetings for the remainder of 1958 and January, 1959:

March 28 (Commander Hotel, Cambridge, Mass)—"Synthetic Fiber Trends in the Textile Industry", Graham M Richardson, E I duPont de Nemours & Co, Inc

May 9 (Lowell Technological Institute, Lowell, Mass)—Joint meeting with Lowell Technological Institute Student Chapter

September 12 (Wachusett Country Club, West Boylston, Mass)—Annual Outing

October 17 (Quartermaster Research & Development Center, Natick, Mass)—"Nonwoven Fabrics", John T Taylor, Rohm & Haas Co

December 5 (Hotel Vendome, Boston, Mass)—"Polymers as Related to Fabric Processing", Victor S Frank, Dewey & Almy Chemical Co; D Donald Gagliardi, Gagliardi Research Corp; H F Mark, Polymer Research Institute; Lloyd H Perry, U B S Chemical Co, Inc

January 16 (Colonial Club, Lynnfield, Mass)—"New Concepts in Optical Bleach Measurements", Charles A Lermond, Fabric Research Laboratories, Inc

Hudson-Mohawk

THE Hudson-Mohawk Section met January 24, 1958 at Jack's Restaurant, Albany, NY, with Chairman Edward A Chevrette presiding.

It was announced that the spring meeting scheduled for March 28 will convene at Jack's Restaurant, Albany, NY instead of in the Johnstown Area. At that time the election of officers will take place. Ladies' Night will be held at the Chelsea House, Tribes Hill, NY, on May 16, and arrangements are being made for the Annual Outing which will be held at Antler's Country Club, Fort Johnson, NY, on June 20.

Arnold Sookne, associate director of the Harris Research Laboratories, Inc, Washington, DC, gave an enlightening talk on "Chemistry as Related to the Useful Properties of Textiles".

Approximately 58 members and guests attended.

Western New England

THE Western New England Section met January 31st at Rapp's Restaurant, Shelton, Conn., to hear John A Zelek, manager of development of dyestuffs, Color and Chemicals Div, Interchemical Corp, speak on the subject, "Progress on Colors for Synthetic Fibers." Mr Zelek's talk was augmented by the film, "Color Magic".

At the meeting, which attracted 55 members and guests, it was decided to begin future technical meetings at 7:00 pm rather than 7:30.

AATCC Calendar

COUNCIL
May 23 (Philadelphia, Pa); Sept 19 (Charlotte, NC); May 1959 (Montreal, Canada)

NATIONAL CONVENTIONS
Oct 30-Nov 1, 1958 (Hotel Conrad Hilton, Chicago); Oct 8-10, 1959 (Sheraton Park and Shoreham Hotels, Washington, DC); Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa); September 28-30, 1961 (Buffalo, NY)

HUDSON-MOHAWK SECTION
Mar 28 (Jack's Restaurant, Albany, NY); May 16 (Ladies Night, Chelsea House, Tribes Hill, NY); June 20 (Annual Outing, Antler's Country Club, Ft Johnson, NY)

METROPOLITAN SECTION
April 11 (New Jersey area)

MID-WEST SECTION
Feb 15 (Hotel Bismarck, Chicago, Ill); April 19 (Netherland Hilton Hotel, Cincinnati, O); June 13-14 (Outing—Browns Lake Resort, Burlington, Wis)

NIAGARA FRONTIER SECTION
Apr 11 (Joint meeting)

NORTHERN NEW ENGLAND SECTION
Mar 28 (Commander Hotel, Cambridge, Mass); May 9 (Lowell Technological Institute, Lowell, Mass); Sept 12 (Outing—Wachusett Country Club, West Boylston, Mass); Oct 17 (QM Research & Development Ctr, Natick, Mass); Dec 5 (Hotel Vendome, Boston, Mass); Jan 16 (Colonial Club, Lynnfield, Mass)

PIEDMONT SECTION
Apr 25-26 (Washington Duke Hotel, Durham, NC); June 6-8 (Outing—Grove Park Inn, Asheville, NC); Sept 19-20 (Hotel Charlotte, Charlotte, NC)

RHODE ISLAND SECTION
Mar 21 (Providence Engineering Society, Providence, RI); Apr 25 (Students Night—Bradford Durfee College of Technology, Fall River, Mass); June 13 (25th Annual Outing—Wannamoisett Country Club); Sept 26 (Management Night—Warwick Country Club); Oct 23 (Providence Engineering Society); Dec 4 (Annual Meeting—Johnson's Hummocks Grille, Providence)

SOUTH CENTRAL SECTION
Mar 29 (Hotel Patten, Chattanooga, Tenn); May 30-31 (Summer outing—Hotel Greystone, Gatlinburg, Tenn); Sept 13 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION
Apr 19 (Alabama Polytechnic Institute, Auburn, Ala); June 6-7 (Summer outing—Radium Springs Lodge, Radium Springs, Ga); Sept 13 (Columbus Country Club, Columbus, Ga); Dec 6 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION
Mar 21 (Rapp's Restaurant, Shelton, Conn); May 16 (Ladies Night—Rapp's Paradise Inn, Ansonia, Conn); June 13 (Outing—Wallingford Country Club, Wallingford, Conn); Sept 26 (Hartford, Conn); Oct 24 (Annual Meeting—Rapp's Restaurant, Shelton, Conn); Dec 5 (Rapp's Restaurant, Shelton, Conn)

Membership Applications

George C Anderson—Sales trainee, Ciba Co, Inc, New York, NY. Sponsors: W H Kieffer, D Cook. (Met).

Gavin T Binner Jr—Supt of textile mill, Clearbrook Woolen Co, Inc, Clearbrook, Va. Sponsors: J E Conway, M E Spring. (W).

James A Bowen—Shift supt, Abbeville Mills Corp, Abbeville, SC. Sponsors: W E Newell, C B Palmer. (P).

Peter Bruinooge—Tech sales, The Sherwin Williams Co, New York, NY. Sponsors: K J Broden, M Silverman. (Met).

Fritz Buxtorf—Head, Service Lab, Sandoz Ltd, Basle, Switzerland. Sponsors: C H A Schmitt, C W Saalfrank.

Thomas O Caton—Head, Piece Dye Dept, Chatham Mfg Co, Elkin, NC. Sponsors: A L Smith, D A Torrence Jr. (P).

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Bullock L Cribb—Field mgr, Morton Salt Co, Chicago, Ill. Sponsors: J Balloch, J W Ivey. (P).

Edward W Curley—Demonstrator, dyes and chemicals, E I duPont de Nemours & Co, Inc, Rumford, RI. (RI).

Howard F Elsom—Sr project engr, Celanese Corp of America, Charlotte, N C. Sponsors: F Fortess, A F Tesi, (P).

Gastao Etzel—Research chemist, E I duPont de Nemours & Co, Inc, Deepwater, NJ. Sponsors: O C Bacon, M Parker. (Met).

Richard Franklin—Chem supervisor, Chem Control Dept, Chambers Works, E I duPont de Nemours & Co, Inc, Penns Grove, NJ. Sponsors; M A Perkins, H H Hully. (DV).

Charles E Hoey—Sales trainee, Textile Chemical Dept, Rohm & Haas Co, Philadelphia, Pa. Sponsors: W C Lindsly, H M Szcepanik. (Met).

Oscar W Howard—Field director, Illinois State Drycleaners Assoc, Decatur, Ill. Sponsors: L B MacFarland, A J Andrews. (MW).

Robert H Mundy—Shift supv, Abbeville Mills Corp, Abbeville, SC. Sponsors: J S Beattie, W M Langley. (P).

Richard A Kern—Chem & colorist, Sandoz Ltd, Basle, Switzerland. Sponsors: C H A Schmitt, C W Saalfrank.

Emily M Owen—Supv, Bacteriology Lab, Research & Development Dept, Colgate Palmolive Co, Jersey City, NJ. Sponsors: C W Dorn, C A Sylvester. (Met).

Joseph C Reno—Vat dyer, Orinko Mills, Philadelphia, Pa. Sponsors: R S Wilkinson, J E Dougherty. (DV).

John T Parkerson Jr—Sales engr, Tennessee Corp, Atlanta, Ga. Sponsors: W E Tiller, W B Griffin. (S).

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Stephen E Staudinger—Sample and asst dyer, Forstmann Woolen Co, Passaic, NJ. Sponsors: E H Metzner, A Brommelsiek. (Met).

Mario C Tedeschi—Head finish & gen supt, General Rayon & Silk Dye Corp, New York, NY. Sponsors: B C Bond, E J Clark. (Met).

ASSOCIATE

Frank Mains—Chief chemist, Javex Co Ltd, Toronto, Canada.

Marjorie A Molloy—Chemist, Federal Trade Commission, Washington, DC. (W).

John F Shelton—Salesman, chemicals, Great Western Chemical Co, Portland, Ore. (PN).

STUDENT

Thomas A Brown, Kenneth Hokanson, and **Stephen Swift**—Students, New Bedford Inst of Technology, New Bedford, Mass. Sponsor: F Tripp. (NB).

H Owen Duffy, Norman Gardner, Eugene Kim, Bobby King, Norman Morris, Robert Scroggins, and **Stephen Thompson**—Students, Alabama Polytechnic Institute, Auburn, Ala. Sponsor: J H Cox. (A).

Anthony Ferraz—Student, Bradford Durfee College of Technology, Fall River, Mass. Sponsor: J Wattus. (BD).

Dae Yee Kim—Student, Lowell Technological Institute, Lowell, Mass. Sponsor: G R Griffin. (L).

TRANSFER TO SENIOR

Thomas L Howle Jr—Supt of Testing Labs, Sidney Blumenthal & Co, Inc, Rocky Mount, NC. Sponsors: S D Bennett, D W Adams. (P).

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

58-1

Education: BS, textile chemistry, Lowell Technological Institute (1957); business administration, Univ of Connecticut.
Experience: Summer employment in following fields: management, retail foods company; finishing department, finishing company; dyehouse, textile manufacturer; development chemist, chemical manufacturer; student instructor (1 year).
Age: 23; single; references; draft status: 4A.
Position desired: management training program or product development-textile chemical field.
Location desired: open.

2-24; 3-10

58-4

Education: BS, textile chemistry, North Carolina State College; textile high school graduate.
Experience: textile laboratory technician; dyehouse production trainee.
Age: 27; single; references.
Position desired: technical sales-service.
Location desired: New York, Philadelphia or California.

2-10; 2-24

58-5

Education: BS, chemistry; post-graduate study.
Experience: defect analyst; plant chemist; dyer; domestic & foreign textile machine sales.
Age: 30; single; references; resume on request.
Position desired: sales; tech sales; administration.
Location desired: New York, New Jersey, some travel, or foreign.

2-10; 2-24

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FUTURE PAPERS

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"An Evaluation of Test Methods for Fulled Fabrics"—Northern New England Section

"Pollution Control of New England Interstate Waters"—Joseph C Knox, New England Interstate Water Pollution Control Commission

"Disposal of Combined Textile Finishing Wastes and Domestic Sewage" —George G Bogren, Weston & Sampson

"Treatment of Mixtures of Textile Wastes and Domestic Sewage. IV—Research in Various Methods of Treatment"—R Hobart Souther and Thomas A Alspaugh, Cone Mills Corp

"Textile Processing Chemicals"—Lester D Berger Jr, Union Carbide Chemicals Co

"The Colorimetric Properties of Bleached Cotton"—E S Shanley, Arthur D Little, Inc

"Recent Developments in Electronic Instruments for Textile Processes"—R Hosmer, The Foxboro Co

"Research and the Future of the Textile Industry"—Raymond Stevens, Arthur D Little, Inc

"Chemical Trends in the Textile Industry"— Milton Harris, Harris Research Laboratories, Inc

"Nuclear Energy—A New Tool for the Textile Industry"—Henry A Rutherford, North Carolina State College

"Automation with Process Instruments"—W H Ridley, The Foxboro Co

"Scouring Grease Wools Neutral"—E C Hansen, General Aniline & Film Corp

"Prevention of Wool Fabric Shrinkage with Polyamide—Epoxide Resin Finishes"—C E Pardo and R A O'Connell, Western Regional Research Laboratory, USDA

"Elimination of Static Electricity from Textiles by Chemical Finishing" —E I Valko, G C Tesoro and W Ginilewicz, Onyx Oil & Chemical Co

"Effect of Laundering on Chlorine Retention and Crease Resistance of Cotton Finished with Dimethylol Ethylene Urea"—Osborne C Bacon Jr, J Edward Smith and Lehman E Hughes, E I duPont de Nemours & Co, Inc

"Wet-soiling Studies on Resin-treated Cotton Fabrics"—Laurence W Mazzeno Jr, Russell M H Kullman, Robert M Reinhardt, Harry B Moore and J David Reid, Southern Regional Research Laboratory, USDA

"The Mechanism of Dyeing Orlon 42 Acrylic Fiber"—T Vogel, J M A deBruyne and C L Zimmerman, American Cyanamid Co

"The Dyeing of Filament Nylon with Acid Dyes"—J A Bittles, J A Brooks, J J Iannarone Jr and H P Landerl, E I duPont de Nemours & Co, Inc

"Evaluation of Carriers for Dacron Dyeing"—Peter J Scott, The Tanatex Corp

"Some Considerations on the Azoic Insoluble Dyes in Printing"—Dorel Marian, Compagnie Francaise des Matieres Colorantes

Local Sections

"Three Sides to the Public Relations Triangle"—M B Eubanks, Riegel Textile Corp

"Reactive Dyestuffs in the Dyeing of Cellulosic Textiles"—Maurice R Fox, Imperial Chemical Industries, Ltd

Research Committee Report

"Laundering Procedures in the Commercial Laundry and in the Home"—AATCC Committee on Dimensional Changes in Textile Fabrics

Contribution

"Combined Treatment—Bleachery Waste and Domestic Sewage"—John L Brown Jr, Cannon Mills Co

Non-Proceedings

"Recent Work in the Mechanism of the Thermal Degradation of Cellulose"—Roy C Laible, Quartermaster Research & Development Command

"Effect of Dye and Acid Valence in Wool Dyeing"—John H Skinkle, Lowell Technological Institute

"A Practical Approach to the Evaluation of a Finishing Agent"—John J McDonald and Robert E Morrison, Lowell Technological Institute

"Rapid Graphical Computation of Small Color Differences"—F T Simon and W J Goodman, Union Carbide Corp

"Identification of Unknown Synthetic Fibers"—Sidney G Smith, Security Mills, Inc.

"A Comparison of Fabric Tear Tests"—Richard Steele, Rohm & Haas Co

General Calendar

AMERICAN OIL CHEMISTS SOCIETY
April 21-23 (49th Annual Meeting, Peabody Hotel, Memphis, Tenn); July 14-18 (Short course on soaps and synthetic detergents, Princeton Inn, Princeton, NJ); Oct 20-22 (Sherman Hotel, Chicago); April 20-22, 1959 (Roosevelt Hotel, New Orleans, La); Sept 28-30 (Statler Hotel, Los Angeles, Calif)

AMERICAN SOCIETY FOR TESTING MATERIALS (COMMITTEE D-13)
Mar 18-21 (Spring Meeting, Sheraton Park Hotel, Washington, D C); Oct 14-17 (Sheraton McAlpin Hotel, New York, N Y)

THE DRYSALTERS CLUB OF NEW ENGLAND
Mar 2 (Hotel Vendome, Boston, Mass); June 20 (Outing—Wachusett Country Club, West Boylston, Mass)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
June 9-12 (National Conference on Materials Handling, Public Auditorium, Cleveland, O)

CANADIAN TEXTILE CONFERENCE
May 6-8 (Queen Elizabeth Hotel, Montreal, Quebec)

DIVISION OF CLOTHING AND TEXTILES IN EXTENSION, TEACHING AND RESEARCH, UNIVERSITY OF GEORGIA
Nov 7-8 (2nd Textile Seminar, Georgia Center for Countinuing Education, Athens, Ga)

THE FIBER SOCIETY
April 30-May 1 (The Clemson House, Clemson SC); Sept 9-10 (Montreal, Que)

INSTITUTE OF TEXTILE SCIENCE
Mar 25 (2nd Annual Meeting asd Fifth Scientific Session, Ontario Research Foundation, Toronto, Ont)

INSTRUMENT SOCIETY OF AMERICA
May 12-14 (Analysis Instrumentation Division Symposium, Shamrock Hilton Hotel, Houston, Texas)

INTERNATIONAL TEXTILE MACHINERY EXHIBITION
Oct 12-15 (Belle Vue, Manchester, England)

DELTA KAPPA PHI FRATERNITY
April 24-26 (New Bedford Hotel, New Bedford, Mass)

INTER-SOCIETY COLOR COUNCIL
Mar 25-26 (27th Annual Meeting, Sheraton Park Hotel, Washington, DC)

LAUNDRY, DRYCLEANING AND ALLIED TRADES' EXHIBITION
July 17-26 (Olympia, London, England)

NATIONAL ASSOCIATION OF HOSIERY MANUACTURERS
April 21-22 (Annual Meeting and Hosiery Industry Conference, Hotel Roanoke, Roanoke, Va)

NATIONAL COTTON COUNCIL OF AMERICA
Oct 1-2 (Chemical Finishing Conference, Washington, DC)

PURDUE INDUSTRIAL WASTE CONFERENCE
May 5-7 (Purdue Memorial Union Bldg, Purdue Univ, Lafayette, Ind)

SOUTHERN TEXTILE EXPOSITION
Oct 6-10 (Greenville, SC)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
Luncheon meetings at the Hotel Roosevelt, New York, NY: Mar 6, April 8, June 10, Sept 9, Oct 8, Nov 12. Outing: May 26-28, Shawnee Inn, Shawnee, Pa)

TEXTILE INSTITUTE
April 23 (Annual Meeting, Nottingham, England)

TUFTED TEXTILE MANUFACTURERS ASSOCIATION
June 5-7 (Dayton Plaza Hotel, Daytona Beach, Fla)

THE SECOND EDITION
of
THE COLOUR INDEX
IN FOUR VOLUMES
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Your prepaid subscription received promptly will insure complete delivery this year of this tremendously valuable work on the free world's dyestuffs and pigments in commercial use. Published by the Society of Dyers and Colourists (British) and the American Association of Textile Chemists and Colorists, these four volumes represent ten years of intensive work in assembling and editing the data. They include approximately 3000 pages of application and fastness properties of coloring matters as furnished by world manufacturers, chemical and structural information, characteristic reactions, index of products and trade names, fastness tests and rating methods, new and old COLOUR INDEX NUMBERS, Schultz and AATCC prototype numbers and a Hue Indication Chart.

Further Particulars from

American Association of Textile Chemists and Colorists

PO Box 28, Lowell, Massachusetts

Inter Alia—Inter Nos

P J WOOD

POLICY

As George Scott-Moncrieff, the celebrated author of an intriguing book on "Edinburgh", once said . . . "Lack of good manners may not be one of the mortal sins, it is frequently their fruit". So we shall scrupulously try to write this column bearing in mind the requirements of good manners, good taste and good humor.

Grandma used to say . . . "You never know what you can do until you try". We would be the last to accuse her of plagiarizing Publilius Syrus, who said . . . "No one knows what he can do till he tries", or words to that effect. It is just as sure that the dear old lady never heard of Publilius Syrus as it is that Mr Syrus never heard of Grandma. She hadn't even been thought of when he started his wise-cracking career.

So, we are going to try.

SOMETHING NEW UNDER THE SUN

Two research workers at Leeds University (our Alma Mater) L Peters and C B Stevens have come up with a novel way of dyeing wool, which is based on the principle that an insoluble pigment may be dissolved in some solvent other than water and the wool may then be dyed in this solution, or the solution may be added to the aqueous dyebath, from which the wool will extract the dispersed solvent containing the dyestuff. It is said that the colors so dyed have excellent fastness, and in many cases, superior fastness properties, especially to such agencies as light, fulling and washing, as compared with colors dyed in the conventional way. The dyeing is said to take place in much shorter times than by the usual methods and without application of heat.

Imagine, dyers, working in a dyehouse, at the height of a sultry summer, no heat, no steam-pipes even, to let cruel scalding drops descend on defenseless bald heads. Is it a dream?

When this appears in print, we purpose sending tear-outs to these ingenious scientists, with a request for the latest information as to any further progress that they may have made since we received this startling announcement from British Information Services recently.

COLOR

For 29 years she served the Color Association of the United States, Inc, faithfully and well; she has decided that she has worked long enough and has now returned to her native California.

Miss Estelle Tennis, when we first knew her, was assistant to Margaret Hayden Roarke, who was executive director of that Association, until a few years ago, when she set Miss Tennis the example by retiring to the sunny shores of the same far western state.

Both these remarkable women had what the high school denizen would call a positive "yen" for color. Both of them had also a vocabulary of names for color that were generally most descriptive and always attractive.

From time to time, Miss Tennis favored us with a sheet of special colors that were suitable for special anniversaries,events and celebrations; for instance,a series of colors commemorating the Perkin Centennial, and another marking the present anniversary of the founding of Jamestown, Virginia. Still another very timely issue was put forth in cooperation with the Belgian Linen Association, consisting of nine colors, in honor of the Brussels Universal and International Exposition to be held this year. The colors, to mention just a few, are appropriately named, Belgian Blue, Ghent Rose, Van Eyck Green, Bruges Pink, Congo Yellow, and Rubens Red.

The only trouble with some of these artistic names is that people like Elmer will be calling them Gent Rose, Van Eek or Van Ache Green, Brudges Pink instead of Gon (like the son in song) Rose, Van Ike Green and Broozh Pink, which wouldn't be fatal, but it wouldn't be according to Hoyle.

FAST COLOR

"In the beginning color was first revealed to man through Nature. The primitive man lived with color through the dawn, sunlight or storm, the mystical rainbow, sunset and dusk".

So begins the little brochure of the comparatively new Vat Dye Institute, of which our friend Henry Herrmann is executive secretary. It is entitled "Your Heritage of Color" and it is very well done.

We suspect that Henry, who is a past president of the American Association of Textile Chemists and Colorists, wrote most, if not all of the text, as we came to learn and admire his individual style of writing during his term of office in that learned society. However, we cannot resist the temptation to correct one statement regarding the translation of the word "mauve", which was the name given to that first aniline color discovered by Perkin a hundred years ago. Says the text, "'Mauve', the French word for the violet-colored marrow flower." Undoubtedly this should be "the violet-colored mallow". Mauve is the French word for mallow, from the Latin malva.

The cover, though simple and homely in design, is a masterpiece of color printing. The illustrations on page 5 likewise. We would like to have been able to feast our eyes on more pages of such coloring. Also, we would have enjoyed further elaboration of the first two pages, which are historical in character, although chiefly (and necessarily) written with that "air of caprice and untrammeled imagination" that Joseph Machlis, associate professor of music at Queen's College of the City of New York, so aptly ascribes to that form of music known as the Concerto.

BOOKS

In the book of Ecclesiastes we read "Of making many books there is no end". Somebody said that Solomon wrote this interesting and, in the main, informative book. What we can't understand is how he could even read the "many books" to which he refers, having such a plethora of spouses. Of course, it is just possible that he had one of them read them aloud to him; he might even have had several read to him simultaneously. It is all we can do to read a book once in a while and write one once in an even longer while, with only one spouse, and a small one at that.

But when somebody presents you with a book, and particularly when such book is the product of his brain, one must read it. Such a presentation came to this writer from a friend in Italy, whose work we have admired to the extent that we have been moved to translate articles that he has written in Tinctoria, our contemporary in that merry land of the pizza. The title of this book is "I Moderni Prodotti Ausiliari per l'Industria Tessile", which, done over into brief English would read "Modern Textile Auxiliaries" and the author, Giuseppe Trinchieri. This is the second edition of this book "adjourned and augmented" as they put it in Italian in their quaint way. We have to admit that the first edition escaped us,so we are unable to make any comparison between the two editions.

In the preface the learned doctor remarks that, since the publication of the first and second editions, not too many novel products have appeared in the field of the subject of the book, but that there has been a notable increase in world production of detergents, wetting agents and emulsifiers and in those resins employed for embossing and finishing textile fabrics.

The book contains 269 pages of text including the list of books and technical journals which have been consulted in writing the book, as well as a list of books, the majority of which are American (only one English) and the rest mostly German or Swiss. The method of treating different categories of textile auxiliaries is brief but effective and covers, where avaliable, the chemical constitution of the materials, the method of manufacture, when this has been published, and a description of the properties and method of application in textile finishing. In many cases an account of the testing method for determining the composition and strength of the chemical is given.

For those who enjoy reading about their art in Italian, it is an excellent book. If there is any fault about the book, it might be that the important subject of resin finishes is hardly accorded sufficient space to treat the matter adequately.

MARVELOUS

The insoluble has been solved! The inscrutable has been unscrewed! A contemporary carries the advertisement of a fabric said to contain "52% Dacron and 52% rayon". This shows a total of 104% fiber content. What a break for the purchaser. Somebody has either made history or mystery.—Q E F.

• PATENT DIGEST •

PAUL WENGRAF

EMBOSSED CALENDER EFFECTS———Shrinking Resin Preprinted Fabrics G,4

USPat 2,776,868 (Sayles Finishing Plant—Russell, Allen——Jan 8, 1957)

The preamble to this patent refers to attacks on fibers which occur in calendering when acid-catalyzed thermosetting resins are used. This disadvantage reportedly may be circumvented by the following procedure:

1) The fabric is roller printed preferably with a pigmented paste termed a "mechanically deformable textile resist", such as a cellulose ester or cellulose ether plus a paraffin wax emulsion.

2) The fabric is dried and framed to the original size and moistened to about 15-20% water content, then glazed on a frictioning calender.

3) The calendered fabric is impregnated with a buffer solution (disodium hydrogen phosphate), which inhibits polymerization of the thermosetting resin to be applied in the following step. This aqueous buffer solution does not wet the resist, but only the nonprinted areas. The fabric was thereupon glazed as in step 2.

4) The fabric is impregnated with a thermosetting aqueous solution, eg, a melamine-formaldehyde dicyandiamide precondensate plus an acid catalyst, dried, cured and rinsed hot and cold.

5) Thereafter the fabric is shrunk in caustic soda, whereupon the glazed areas obtained by printing the resist are somewhat raised from the nonlustrous, compacted and shrunken areas. This step is optional.

The effect obtained by this method can be described as follows: the resist (step 1) is fixed by the thermosetting resin, which penetrates the fabric (step 4), while the buffer solution (step 3) inhibits resin formation on the nonprinted areas; thereby possible acid attacks on the nonprinted portions are prevented.

Among the references cited by the Patent Office:

Brit Pat 521,906 (Bleachers Assoc /1940): chintz-type fabrics are produced by applying several coatings, the lower ones being thermoplastic, the upper ones, thermohardening resins.

Brit Pat 592,649 (Cilander A G/ 1947): printing of fabrics with dimethylolurea and a potentially acid catalyst, embossing, curing, and finally shrinking in relaxed state with concentrated lye [cf *Am Dyestuff Reptr* 37, 697 (1948)].

USPat 2,531,814 (Heberlein Patent Corp/1950): wash-resistant pattern effects are obtained by printing a (pigmented) chlorinated rubber solution in registry with an aqueous gum resist, whereupon the rubber-printed areas become resistant to subsequent shrinking and parchmentizing [cf *Am Dyestuff Reptr* 40, 279 (1951)].

USPat 2,681,867 (Calico Printer's Assoc/1954): embossing effects are produced by preprinting, as resists, acetates or formates of weakly basic metals, such as Al, Sn, Zn, etc, impregnating with thermosetting solutions plus catalysts, embossing, and curing.

FLAME- AND WATERPROOF FINISH———Metal Salts plus Hexamethylene Tetramine Exposed to Ultra Red Radiation G,2,03

USPat 2,780,566 (de Luxembourg et al—Feb 5, 1957)

The use of various metal salts is common practice in the flameproofing of cloth. The inventors claim specific flameproofing and hydrophobing effects when combinations of aluminum sulfate, lead acetate, and small amounts of hexamethylene tetramine are applied. When the boiling solutions of the aforementioned metal salts are blended, the formed precipitate of lead sulfate reportedly may be redissolved to a great part by adding hexamethylene tetramine. The solution is filtered in the dark and used to impregnate textiles (preferably also in absence of light). An essential feature of the method is the exposure of the thus-treated fabrics to "black rays" of the infrared radiation.

Complete penetration of the fibers is claimed, the pores being unobstructed by undesirable deposits. The fibers were found to be both waterproof and flame-resistant.

Among the references cited by the Patent Office:

USPat 2,520,103 (Am Cyanamid/ 1950): a flameproof finish containing, in addition to monoguanidine phosphate and cyanamide, up to seven percent of a polyalkylene polyamine, eg, hexamethylene tetramine.

USPat 2,542,064 (Permafuse Corp/ 1951) describes an apparatus for making a bonding member to attach friction material to brake shoes; asbestos fibers are impregnated with a "resinoid" liquid and dried by infrared lamps.

FLAME-RESISTANT WASHFAST EFFECTS———Guanylmelamine Pyrophosphate Applied G,2,03

USPat 2,779,691 (Am Cyanamid——Loukomsky ——Jan 29, 1957

Salts of guanylmelamine with pyrophosphoric acid were found to inhibit flame propagation in cellulosic fiber materials to a high degree.

As a preliminary step, *guanylmelamine hydrochloride* is prepared by reacting dicyandiamide with anhydrous hydrochloric acid at 100-150° C. The water-insoluble *pyrophosphate* is precipitated *in situ* within the fibers by an impregnation of the goods with guanylmelamine hydrochloride, followed by a treatment with pyrophosphoric acid or a water-soluble salt thereof.

To prevent dusting of the pyrophosphate of guanylmelamine, it is advisable to incorporate a thermosetting resin, preferably methylated methylomelamine, as a fixing agent. It may be applied from a separate aftertreating bath, or precipitated guanyl melamine pyrophosphate may be suspended in the resin solution that is resistant to the pyrophosphate.

Example: A sample of herringbone cloth was impregnated with a 20% solution of guanylmelamine hydrochloride, dried, passed three times through a 10% solution of disodium dihydrogen pyrophosphate, dried again and padded in 5% methylated methylolmelamine, dried and cured. The US Army Flame Resistance Test, which is described in the present specification, produced a hole 2-2½" in diameter; after 24 hours washing in running water and drying, the diameter of the burned hole was the same, proving the washfastness of the effect.

Among the references cited by the Patent Office:

USPat 2,305,035 (Sylvania Ind Corp /1942): describes alkylolamine guanidine phosphate as a flame-retarding agent.

US Pat 2,418,525 (Pollack/1947): rendering textiles nonflammable, water-resistant and mildewproof by a treatment with pyrophosphoric acid and melamine [cf *Am Dyestuff Reptr* 36, 438 (1947)].

USPat 2,421,218 (Pollack/1947): a nonflammable, water-resistant finish is produced by impregnation with a water-insoluble melamine pyrophosphate coated with a melamine-formaldehyde condensate.

USPat 2,537,840 (Am Cyanamid/1951) protects the method of preparation of guanylmelamine hydrohalide from dicyandiamide and a dry hydrogen halide.

DYEING GLASS FIBERS—— Impregnating Color-Pigmented Alkylalkoxy Silanes C,4,07

USPat 2,778,746 (Alex H Kerr & Co——Steinman, Eberz——Jan 22, 1957)

Many attempts have been made to impart satisfactory and durable shades to glass fibers. While some useful solutions to this problem have been advocated in the past, these processes reportedly did not provide strong fabrics having a desirable hand.

A colored, flexible glass fabric which is substantially washfast may be produced, according to the current patent, by treating a perfectly clean glass fabric with a water-soluble coloring agent, a water-soluble or dispersible hydrolysis product of an alkylalkoxysilane plus a noncationic (perferably a nonionic) wetting agent. The silane is in the "A" stage of cure in contrast to the "B" stage, where the product is alcohol soluble, and to the "C" stage, where the silane is soluble in aromatic or chlorinated hydrocarbons.

Example: A glass fabric, freed from organic sizes by passage through an electric furnace at 1200° F, was first immersed in a liquid polymethylsilicone oil dispersion, squeezed, dried, and heat set at 600° F; it was then prepared in an aqueous dispersion of triethoxy silane plus a polyoxyalkylene surfactant and a pigment dye of the phthalocyanine group. After heat setting at 450° F, a uniformly colored, soft fabric resulted.

Among the references cited by the Patent Office:

USPat 2,390,370 (Corning Glass Works/1945): bonding glass fibers by coating them with hydrolizable organosilanes.

USPat 2,582,919 (Owens Corning Fiberglas/1952): coloring of glass fibers composed of siliceous and nonsiliceous materials by leaching out the nonsiliceous portions in an acid treatment, thus rendering the fibers' surface more porous and adsorbent.

Correction

Your attention is called to a typographical error in the formula for gluconic acid, which appeared in the second column, page 60, January 27th issue.

The formula should read:

$$C_5H_6(OH)_5COOH$$

Abstracts

Textile Inter-fiber Competition, 1949-1955

Anon, *Textile Organon* **28**, 157-72, Supplement, October, 1957.

This special supplement presents data on 102 end uses of cotton, wool, the man-made fibers, silk, linen, and the hard and soft vegetable fibers by years from 1949 through 1955. These data were prepared by Du Pont's Textile Fibers Dept.

The survey covers the gross poundages of certain fibers consumed in the production of a wide range of textile products in the United States.

Tables are presented, summarizing the consumption of cotton, wool, the man-made fibers, silk and linen by end uses, for 1937 and for 1949-55, and also showing the mill consumption of these fibers.

The data are divided into five main classifications: men's and boys' wear, women's and misses' wear, children's and infants' wear, home furnishings, and other consumer-type products, and are further broken down into specific uses, eg, suits, sheets, underwear, hose, blankets, carpets, curtains, etc. All of the survey data are naturally estimates.

Over the period covered, these data show that there is a trend to the use of lighter weight apparel in practically all categories.

The survey points out that textile interfiber competition is not on a simple pound-for-pound basis; eg, nylon stockings definitely outwear silk stockings, and nylon rope will not rot in water, whereas cotton and hemp rope will deteriorate. It is estimated that the noncellulosic man-made fiber consumption figures should be at least doubled if their higher utility poundage is to be reflected.—WHC

Acrylic Fibers in Dyeing—— Dyeability vs Chemical Resistance

Anon, *Dyer* **117**, 877-81, May 24, 1957

The cardinal difficulty of dyeing acrylic fibers is one of lack of ionic sites on the fiber, sites necessary for the lodgment of most classes of dyestuff. It has been overcome by four methods:

1) Modifying the polymer by copolymerizing a polar monomer with the acrylonitrile. Thus, vinyl pyridine has been used, possibly in Acrilan; vinyl acetate has been used (with vinylidene, a close relative of acrylonitrile) in Darlan; and dye-receptive groups have been grafted on to polyacrylonitrile in Zefran.

2) By having present cuprous ions which will form complexes with the acrylic fibers and still retain an affinity for acid dyes, the cuprous ion acting as a go-between.

3) By putting to work some acid groups which appear to be adventitiously formed in the polymerization of the acrylonitrile by hydrolysis of nitrile groups; these afford good sites for the positively charged dye ions of basic dyes.

4) By making use of the versatility of disperse dyes which will dissolve in a variety of organic materials, fortunately including acrylonitrile.

The development of acrylic fibers with modified structures, so that they contain large numbers of sites for dyestuffs, is so far advanced that there can be little doubt that it is these modified fibers such as Acrilan, Orlon Type 42, Dralon, Pan, Creslan, Zefran and Darlan that will be mostly used.

It must be added, however, that the modifications that have been made to the polymer by inclusion of other monomers with the acrylonitrile, while giving easier dyeing, have also made the fibers more susceptible to chemical attack. The superb chemical resistance and weathering properties of the original Orlon Type 81, which is believed to have been a homopolymer of acrylonitrile, are not matched by the properties of the newer easy-to-dye acrylics. It is quite impossible to achieve superb chemical resistance to everything except dyestuffs, and easy dyeability has to be paid for by a decrease in resistance to acids, alkalis, salts, and the weather.—WHC

Disperse and Anionic Dyes on C F Nylon

Peters, H W and Turner, J D, *Dyer* **118**, 665-6, Oct 25, 1957

The dyeing characteristics of nylon are influenced by two properties of

the yarn: amine end-group content, and physical structure. The former is controllable within practical limits by routine tests, but it is not yet possible to ensure absolute uniformity of physical structure. Two factors are involved: overall degree of order (crystallinity) and degree of longitudinal orientation. These affect the rate of dyeing, in that increase in either will bring about a decrease in dyeing rate.

A series of simple tests has been developed which make it possible in general to decide what type of variation is present. The faulty fabric is dyed with four dyes as follows:

1) Duranol Brilliant Blue BN (C I Disperse Blue 3). This dye is typical of the level-dyeing disperse dyes, and covers both chemical and physical variations.

2) Solway Blue BN (C I Acid Blue 45). This dye is very sensitive to amine end-group differences, but covers physical structure variations.

3) Durazol Blue 2R (C I Direct Blue 71). The dyeing rate of this dye is very dependent on the physical structure of nylon. It is also, being an anionic dye, sensitive to chemical variations.

4) Multamine Black B (a mixture of disperse dyes). This dye is used to show up variations in luster only.

The precise method of applying these dyes is described. By comparing the first three dyeings it is generally possible to determine whether dyeing irregularity is due to physical or chemical variation.

The authors discuss the possibility of new and modified dyeing methods for covering variations due to different dyeing rates, and suggest that the pad-fixation method is one of the most promising. They recommend the use of the fluid bed as a suitable means of effecting rapid dye fixation. They point out the advantages (in dyeing with the disperse dyes) of the enclosed jig, compared with the open jig.—WHC

Dyeing Possibilities of U-V Light Absorbers

Gantz, G M and Sumner, W G, *Dyer* **118**, 419, Sept 13, 1957

The adverse effect of light on both natural and synthetic textile materials is quite well known. Although the subject is old, it is very complex and can be influenced by a variety of factors.

Simple and economical methods of utilizing stable ultraviolet absorbers to improve the lightfastness and weatherability of textiles have not been established. A major difficulty is determining what wave lengths of ultraviolet, visible, or infrared radiation are responsible for degradation. Other factors, such as mildew, presence of moisture, oxygen or industrial fumes, sensitizing action of dyes or dulling pigments, can influence degradation during outdoor exposure. On the other hand, use of accelerated laboratory tests (eg, in the Fade-Ometer) may give unrealistic results, since this device is known to have a higher percentage of ultraviolet energy than sunlight.

The possibility of using ultraviolet absorbers to improve the lightfastness of dyes is discussed by the authors. The most stable and efficient of all the organic compounds studied to date appear to be some of the substituted benzophenones (eg, General Aniline's "Uvinuls" and American Cyanamid's "U V Absorbers"), which penetrate into synthetic fibers much like acetate dyes. If such a compound is added to a regular dyebath, in certain cases improved lightfastness is obtained. An absorber can also be incorporated into a spinning dope to improve the lightfastness of certain pastel shades of spun-dyed fibers.

There is also the possibility of using ultraviolet absorbers to enhance the weatherability of undyed textiles. It is generally accepted that ultraviolet light plays an important part in fiber deterioration outdoors. Dyes and pigments may retard the effect of light or act as sensitizers to increase the rate of degradation.

The authors believe that the application of ultraviolet light absorbers deserves further investigation.—WHC

Rotproofing of Textiles

Higgins, E, *J Textile Inst* **48**, P749, November, 1957

The speaker discussed the behavior in nature and in the laboratory of the microorganisms responsible for the rotting of textile fabrics, and pointed to the need to get away from "the practice of the classical pathologist" in dealing with the practical problems of rotproofing in the field.

He said that it was perhaps inevitable that the standards for the protection of textiles from damage by microorganisms were originally based on "medico-pathological" methods, using pure cultures, but that this was "an unfortunate and wholly misguided direction". He believes that real progress in this field is dependent on discovering a test that gives results at least in agreement with behavior in practice.

He stated that after several years of experimentation, these few facts seem to be fundamental, and experimentally verified:

1) For this work the pure organism derived from the museum of pure cultures must be substituted by the mixed wild population of microorganisms to which the textile is destined to be exposed in practice.

2) Probably the best source of such organisms is that from which the mixed organisms will be derived, ie, the soil.

3) While, qualitatively, the soil population is much the same everywhere, its quantitative composition depends on the soil conditions.

4) The variation in physical and chemical constitution of soils which regulate the determinant conditions for its population is too great to make soil as such likely to prove a standardizable material.

The speaker proposed that an attempt be made to produce "a synthetic soil-like medium" which would be standardizable and reproducible everywhere, imitating a well-cultivated soil as nearly as possible in physical properties, porosity, water retention, etc. He described work which had been carried out along these lines in his laboratory, and promised full publication of his results at an early date.—WHC

Polythene Use-development: Applications of Courlene Monofilaments

Anon, *Man-made Textiles* **34**, 73, November, 1957

For some years monofil polythene yarns have been produced and marketed in England by Courtaulds Ltd under their trade mark "Courlene". These yarns are popularly associated with industrial uses such as specialized filter fabrics. There are, however, some fabrics in regular production which are recognizable as conventional textile fabrics, competing with natural and man-made fibers in established fields.

Samples of such fabrics are attached to the magazine page. These include a light-weight brown fabric for shirts and a heavier white fabric for overalls and laboratory coats, both designed to take full advantage of the chemically inert properties of polythene and its resistance to both acids and alkalis.

Another fabric shown is a multicolor curtain cloth, eminently suitable for shower screens, since it absorbs no moisture, or for bathroom or kitchen curtains. The yarns used are all spun-dyed, giving a high degree of fastness. Any soiling is necessarily on the surface of the fibers, and a rinse in warm water and detergent is sufficient to remove it. The draping and crease-resisting properties are said to be good. Ironing is not possible, owing to the low melting point of the fiber.—WHC

BOOK REVIEW

Statistical Methods in Research and Production — 3rd Edition

O L Davies; Oliver and Boyd, Tweeddale Court, Edinburgh

The object of this handbook is to bring together under one cover those methods of statistical analysis which are most likely to be of use in the chemical industry. This object is more than adequately fulfilled in easily understood terms by the authors. The success of previous editions has made this book the standard handbook for scientific and industrial research workers. The success of the book is no doubt greatly due to the fact that the chemists, statisticians, engineers and physicists who wrote the work have worked as a team, and produced a consistent and readable work that requires only an average mathematical knowledge for understanding.

This new edition has gone through a very extensive revision, and a new emphasis on confidence limits rather than tests of significance is apparent. This change has come about through advances in theoretical statistical methods with subsequent application to industrial research along with the amount of experience the authors have had with modern developments in this field. New topics covered include "economics of testing and experimentation; sequential sampling; the estimation of variance components and their confidence limits; the analysis of covariance."—RJK

Encyclopedia of Chemical Technology — Vol XV (Waxes to Zymosterol)

Raymond E Kirk and Donald F Othmer; Interscience Publishers, Inc, New York; 1956; Sub price $25.00, single price $30.00

With this volume, Interscience Publishers, Inc and Editors Kirk and Othmer have completed an ambitious and timely undertaking of nine years duration.

This last volume, XV, includes a 620-page index to the complete set of 15 volumes. It has approximately 50,000 entries. Any topic discussed in the 13,805-page encyclopedia can be found by its name entry in this final volume, which also includes entries from "waxes to zymosterol". To owners of the previous volumes the fifteenth is indispensable.

"The eight-hundred-odd articles in the Encyclopedia comprise 13,805 text pages: longest letter, 'C', 1946 pages; longest article, 'Fatty Acids,' 128 pages. The articles were contributed by over 1,000 authors. Of these, 60% were from industry, 23% in universities, 9% in government (including National Health Service, Army, Navy, and Department of Agriculture), 5% from research institutions, and 3% consultants. Almost all these authors are working in the United States."

Because of the rapid growth of chemical technology, one is tempted to ask what is being done to keep the series up to date. A "Supplement Volume," similar in size and format to the regular volumes, will deal with subjects in which there have been developments of exceptional interest since the original articles appeared and will bring them up-to-date. Sample entries: Computers in Chemical Technology—Steroids with Cortical Hormone Activity."

The work has been hailed by an international audience as a monumental contribution to the literature of chemical technology and the reviewer can only concur by offering his added praise.—RJK

Molecules and Crystals in Organic Chemistry — 2nd Edition

E A Van Arkel; Interscience Publishers, Inc, New York; 1956; $4.75

It often happens that, years after one's formal education has come to an end, there is a realization that the science one is practically engaged in has undergone a fundamental reorientation, the theory of which is somewhat beyond the practical man's training and experience. Two modes of adjustment to this realization suggest themselves. One can ignore this "latest trend" because, in all probability, it will have no immediate bearing on one's work, or one can look further into the phenomena with the hope of gaining some insight that might aid in solving the practical every-day problems associated with research and industry. If one chooses the former path there is nothing more to be said, but if one chooses the latter, Professor Van Arkel's book provides a real opportunity to catch up with what has been done in formulating a theory of the heteropolar bond and to correlate what is known of the structure and properties of substances with this model. Professor Van Arkel has the gift of being able to present difficult subject matter in an orderly and readable manner. This is the second English edition of a book which should be understandable to any college graduate who has the interest to read it. The book is not relegated entirely to the field of inorganic chemistry as it includes, among other topics, Chemical Reactions, Resonance, Nonelectrostatic Bonds, Polarization, and Colloids.—RJK

Industrial and Manufacturing Chemistry — 7th Edition; Part I — Organic

Geoffrey Martin; revised by Edward I Cooke; Philosophical Library Inc, New York; 1955; $17.50

This volume presents in encyclopedic form a brief review of manufacturing practices in a wide variety of processes. Classification is according to industry, and includes Oil, Fat, Varnish, Soap, Petroleum, Sugar, Starch, Cellulose, Fermentation, Resin, Rubber, Plastics, Leather, and Drugs as well as many others. Of particular interest to textile chemists are sections on Starch, Cellulose, Industrial Gums and Resins, Industry of the Synthetic Coloring Matters, Industry of Natural Dyestuffs, Textile Fiber, Bleaching and Waterproofing Industries, and the Dyeing and Color-Printing Industry.

Because of the scope of subject matter covered, the treatment of individual processes is very curtailed in many instances. Industrial equipment is discussed and pictures or drawings of many important units are presented. Process flow sheets are also included in some instances.

This volume is of particular value as a quick reference for management, consultants, and legal personnel. It might also serve as a text or reference in a formal course in industrial chemistry. For the research chemist or technician, it will provide a ready reference on important aspects of processes related to his field. However, the necessary curtailment of detailed information makes this book unsuited as a substitute for one of the larger technological encyclopediae or for books devoted specifically to a given industry or process.—GG

News of the Trade

Symposium on Cellulosic Textiles to Highlight 28th TRI Meeting

An all-day symposium on new developments in cellulosic textiles and evaluations of their expanding horizons in the industry will highlight the 28th Annual Meeting of the Textile Research Institute next month (March 13-14) at the Hotel Commodore, New York. Paul B Stam, director of research, J P Stevens & Co, Inc, symposium chairman, will serve as moderator of a panel discussion of questions and comments submitted by the audience. This will follow the presentation of six papers covering viscose rayon, acetate, and cotton.

Featured speaker of the meeting will be Raymond H Ewell, vice chancellor for research of the University of Buffalo. Dr Ewell will speak on "Research and Education in Russia".

G T Gardner, executive vice president, Riegel Textile Corp, is serving as chairman of the TRI Annual Meeting Committee, which has arranged the following technical program:

Thursday, March 13

Morning Session—Wayne B Sisson, American Viscose Corp, chairman.

"TRI Research in 1957"—Howard J White Jr, TRI;

"The Physical Properties of Rayon and Nylon 66 Tire Cord at Elevated Temperatures"—Frank R Charles, Industrial Cellulose Research Ltd.

Afternoon Session—John W Liska, The Firestone Tire and Rubber Co, chairman.

"Synthetic Fibers in Industrial Uses"—J M Swanson, E I duPont de Nemours & Co, Inc;

"Ultraviolet Absorbers"—R A Coleman and W H Peacock, American Cyanamid Co.

Friday, March 14

Symposium on New Developments in Cellulosic Textiles—Paul B Stam, J P Stevens & Co, Inc, chairman.

"Nontextile Applications of Viscose Rayon"—John A Howsmon, American Viscose Corp;

"Whither Rayon"—John Wharton, Courtaulds (Alabama), Ltd;

"Predicting Commercial Acceptance of a Fiber"—Joseph L Baruch, Celanese Corp of America;

"Recent Developments in Lofted Acetate Yarns"—R E Semmler, Eastman Chemical Products, Inc, and Richard F Dyer, Tennessee Eastman Co;

"Some Concepts of Cotton Research"—George S Buck Jr, National Cotton Council of America;

"Chemical Modification of Cotton: Progress and Current Status"— C H Fisher, Southern Utilization Research & Development Div, ARS, USDA.

The Luncheon Session on Friday will be conducted by Richard T Kropf, Belding Heminway Co Inc, TRI trustee, who will introduce newly-elected trustees and officers. Walter Regnery, Joanna Cotton Mills Co, TRI president, will speak on "The State of the Institute."

The registration fee for the meeting is $8.00 and luncheon tickets are available at $5.00 per day. Reservations may be made by writing the secretary, Textile Research Institute, P O Box 625, Princeton, NJ.

Colton Chemical Expands Cleveland and Elkton Facilities

Expansion of production facilities in the Cleveland plant of Colton Chemical Co, A Division of Air Reduction Company Inc, Cleveland 14, Ohio, has been completed. Increased plant capacities at Cleveland provide for the manufacture of Flexbond copolymer emulsions. These emulsions were previously made only at the Elkton, Md, plant.

The stepped-up facilities in Colton's Elkton plant, which will be completed shortly, will make possible the increased production of Vinac emulsions, which are employed in textiles and for other uses.

Du Pont Adds New Distribution Point For Dimethylamine

Du Pont's Grasselli Chemicals Department has announced the addition of dimethylamine dilution facilities at its Cleveland, O, plant. Shipments of dimethylamine in aqueous solution will be made from that point in tank truck or tank car lots.

According to R K Stoll, Cleveland district manager, the addition is being made to improve service to customers in the area, and to handle an increasing demand for the chemical. Initial deliveries were made last month.

"The Old Order Passeth"—A Profile of Ernest Kay Halbach (1883-1958)

by Williams Haynes

Almost the last link with the dye industry of the Old Regime was snapped when Ernest Halbach died, January 24, at the age of 74. His long career was a true Horatio Alger story, a pattern now as out-of-date in business as in boys' books. He started as an office boy with Wm Pickhart & Kuttroff; he ended an honored dean of the industry.

After sound training in the Three R's—reading, 'riting, and 'rithmatic—he passed up an appointment to West Point for a foot on the bottom rung of the ladder with the prominent, prosperous American sales agents of the famous Badische Works. In this atmosphere the ambitious lad of sixteen was inspired to become a chemist.

"Don't do it," warned his big boss, Adolph Kuttroff. "There is no future for a dye chemist in America. You will end up matching shades."

Telling the story years later, Halbach said, "He was the wisest, kindest, strictest man I ever knew, but like many of the old timers of those days he could not believe that complex coal-tar colors could ever be made in America. His advice was oh so wrong in its reasoning, but quite right in its conclusion. I haven't the making of a chemist, so instead of studying chemistry, I took some night business courses at the West Chester Teachers College. Soon they sent me to Boston to learn selling dyes the hard way, to the New England textile mill."

Nineteen years later, he was back in Philadelphia, manager of that branch, and in 1923 he became sales manager of Kuttroff-Pickhardt & Co, Inc.

The next year, Herman Metz, Hoechst representative in the U S, learned that the leading German chemical firms were planning a merger. Each had its own sales agent here, so to prevent any one becoming exclusive American representative of the proposed consolidation Metz persuaded the agents of Badische, Cassella, and Bayer to join with him in the General Dyestuff Corporation. During World War I, Metz had fought a rough and tumble fight in defense of the German dye companies. Out of this experience he

insisted that the American agents finance their own company in order that it should be wholly owned by American citizens.

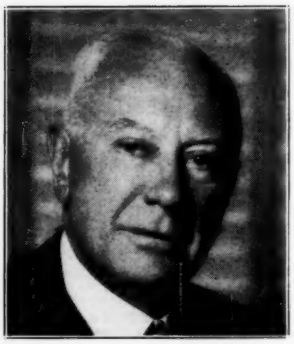
When the I G was organized in 1926, General Dyestuff became its American agent. Kuttroff was chairman; Metz, president; Halbach, secretary-general manager. When Kuttroff died in 1930, Metz became chairman, Halbach moved up to the presidency.

In 1929 the I G bought from Grasselli the old pre-war Bayer plant at Albany, N Y. They rechristened it the General Aniline Works; concentrated here American production of intermediates, dyes, and specialties; and put the sales of these products into the hands of General Dyestuff.

During the hard, lean 1930's Halbach, a consummate salesman himself, showed that he was also a great sales strategist and leader. He recruited and trained one of the most efficient sales forces in the dye field and reinforced them with the largest staff of chemists and colorists with splendidly equipped laboratories at New York. Boston. Providence, Philadelphia, Charlotte, and San Francisco. The enthusiasm and loyalty of these men, salesman and technicians alike, their esprit de corps, was high tribute to his own devotion to his work, his warm, helpful friendliness, his sense of fair play.

Ernest Halbach was a hard-hitting, but clean-handed competitor. General Dyestuff had always its share of the tonnage business, but he always bore down upon the new, improved colors, the very latest, best dyeing assistants. He was proudest, I think, of the great missionary work his men did for better dyeing and finishing, better textiles for the consumer. Characteristically, he ignored his own part in constantly urging General Aniline to duplicate in this country every worthy new dye and specialty developed in the German laboratories, his long fight against commercial bribery and his distinguished services to the War Production Board during World War II. His competitors know best what a constructive force he exerted in the industry during the long years of his leadership.

During World War II, the Government took over General Aniline & Film as an enemy-owned property. The Government was thus compelled to buy control of General Dyestuff, because, without this sales organization, General Aniline could not be operated successfully. There was legal urgency in this compulsion which, in turn, bred other compulsions, and the American stockholders were urged



Ernest Kay Halbach

to sell upon patriotic grounds. When they agreed to accept the Government offer for their stock, their president felt compelled to go along with them. At the Government's behest, Halbach continued to head the organization. But it was thought to be a situation that could hardly be cooperative and congenial, so after a couple of years he resigned.

Among the assets of General Dyestuff was a stock interest in the Verona Chemical Co, makers of some intermediates, photographic chemicals, and aromatics for the cosmetic industry. Back in 1902, Verona had been started by Edwin Kuttroff, son of Ernest Halbach's first employer, to produce vanillin, saccharine, and other then-new coal-tar synthetics. In 1938, prompted by Halbach and in part financed by General Dyestuff, his brother-in-law, F H Stafford, bought Verona and was its head till 1950 when he died and Halbach assumed general control.

After he resigned from General Dyestuff, Halbach was able to purchase that corporation's interest in Verona. He added a new division, Verona Dyes, a sales agency for selected domestic and imported dyes. Almost his first act was to equip and man an ultramodern dye-application laboratory at the headquarters in Union, N J. Just before his health barred him from business activity, he negotiated with Eugene Markush a merger of Verona and the Pharma Chemical Corp.

No one who knew Ernest Halbach ever questioned his forthright patriotism. After years of friendship, I was, as a director of the reorganized Verona, closely associated with him in recent years. I know how he was cut to the quick by the Government's action with regard to General Dyestuff. It outraged his sense of fair play; it killed his justifiable pride in what had been his life work. Yet it could not embitter his honest, friendly, courageous spirit. Out of what seemed the wreck of his career, he started at nearly 70, to build anew.

He had lived for some 40 years in Short Hills, NJ; a prominent, popular member of the community. He married twice: first, to Elizabeth Stafford, and several years after her death, to an old friend of the family, Mrs Helen Page Woodell. By his first wife he had three daughters; two survive him, Mrs John Kemmerer and Mrs Roy Bumstead Jr.

Ernest Halbach was always a good neighbor and an active citizen. His clubs included the Union League and Merchants in New York, Merion Cricket in Philadelphia, Baltusrol Golf and Pine Valley.

In Christ Church, Short Hills, an impressive memorial service was held, attended by a throng that filled even the side aisles with friends of every rank from every sphere into which his active life had lead him. The rector paid a brief, fitting tribute to his friend and vestryman.

"Ernest," he emphasized, "was a four-square man."

Emery Acquires Vopcolene Div

Emery Industries, Inc, Cincinnati, has acquired the Vopcolene Division of the Vegetable Oil Products Company for an undisclosed sum. According to A W Schubert, executive vice president of Emery, the transaction will become effective April 1 and will include the entire property, production facilities, trademarks, etc, of the Vopcolene Division in Los Angeles. Calif. No changes in personnel are contemplated and the operation, which will become the Vopcolene Division of Emery Industries, Inc, will remain under the direction of Carl Williams, present general manager.

Currently the Vopcolene Division is said to be the only manufacturing plant on the West Coast producing a diversified line of fatty acids. Emery plans substantial expenditures for expansion and improvement of production facilities.

This is the third major expansion by Emery in the last two years. The other two were the acquisition of the fatty acid manufacturing facilities of the S F Lawrason and Company, Ltd in London, Ont, and the multimillion dollar joint venture with Monsanto Chemical involving the construction of a new plant at Nitro, W Va, to fractionate tall oil into rosin and fatty acids. The Monsanto-Emery plant and the extensive moderization and expansion of the Canadian plant are nearing completion.

Aerial view of Vopcolene Division of Vegetable Oil Products Company acquired recently by Emery Industries, Inc, Cincinnati, Ohio. Sale included the name, products and manufacturing facilities (pictured), located in Los Angeles.

Australian Textile School Begins 2nd Year

The School of Textile Technology, New South Wales University of Technology, Kensington, NSW, Australia, reputedly the first such school at the university level in the southern hemisphere, completes its first anniversary this month.

The School began providing undergraduate courses in February, 1957. After a first-year basic science training, students are able to choose from one of four options, viz, Textile Manufacture, Textile Chemistry, Textile Physics, or Textile Engineering. Each course leads to the degree of Bachelor of Science (pass and honors) after four years of study. Compulsory subjects in the humanities and six months' industrial training are integral parts of each course.

The academic staff of the School consists of: Prof M Chaikin, head of the school (textile physics and textile engineering); Associate Prof A Johnson, head, School of Textiles, East Sydney Technical College (fabric manufacture); A Datyner, senior lecturer (dyeing and finishing); C H Nicholls, senior lecturer (textile chemistry); F Wood, senior lecturer (textile testing); and A Dircks, lecturer (yarn manufacture).

As many as 23 matriculated students enrolled in the first year of the School's operation. In the postgraduate research field, an Australian Atomic Energy Commission student is studying for the degree of PhD and there are five MSc candidates engaged in a variety of research projects.

The School at present occupies a number of physical and chemical laboratories within the main University block and plans are proceeding for the completion in 1958, of a new building, which will house a wide variety of textile processing machines. A comprehensive range of testing instruments has been purchased and a testing and trouble-shooting service to industry will shortly come into operation.

ITS Meeting

The Institute of Textile Science Inc will hold its Second Annual Meeting and Fifth Scientific Session March 25th at the Ontario Research Foundation, Toronto, Ontario.

Theme of the meeting will be "The Significance and Usefulness of Wear Testing".

Goodrich Changes Names of Dinitrile Fiber

Adoption of a new name for its dinitrile fiber has been announced by the B F Goodrich Chemical Co, Cleveland, O. The fiber, formerly known as Darlan, will henceforth be known as Darvan.

Development of the fiber, described as one of the most versatile manmade apparel fibers, was announced about two years ago by Goodrich.

55th Phi Psi Convention

The 55th Annual Convention of Phi Psi will be held at the national textile fraternity's birthplace in Philadelphia April 24-26. The group will be the guests of Alpha Chapter of Phi Psi at Philadelphia Textile Institute, and convention headquarters will be at the Ben Franklin Hotel. National president George F Long, Harchem Division, Wallace and Tiernan, Inc, has named Roger J Gentilhomme, Sanforized Division, Cluett-Peabody Co, Inc, convention chairman *ex officio*, with Charles Baker, president of Alpha Chapter, chairman.

Becco Begins Deliveries From Framingham

First deliveries of Becco hydrogen peroxide have been made from the new distribution center just completed in Framingham, Mass, by Becco Chemical Division, Food Machinery and Chemical Corporation, Buffalo, N Y.

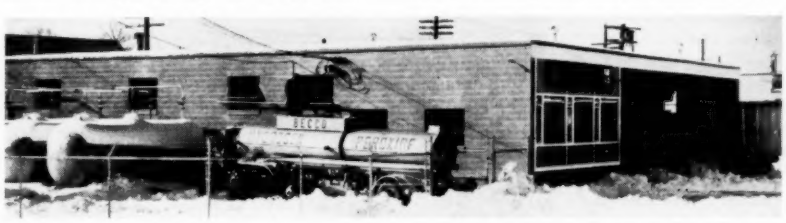
The new center, to serve the New England area, is located on Fountain Street, just west of Route 128, and is housed in a new 6,000-sq-ft building. The 22,000-sq-ft site provides plenty of room for external storage tanks and future expansion.

The new Framingham center replaces the company's former distribution center in downtown Boston, which was established in 1933. It reportedly provides greater storage and filling capacity and is more conveniently located for receiving and dispatching shipments to the textile finishing plants, paper mills, and other industrial plants in New England.

The new center will receive material from Becco's main production plant in Buffalo in tank car quantities. Shipments from the center will be made in tank trucks, drums, or glass carboys.

Becco also maintains similar distributing centers in Jersey City, NJ, to serve the Middle Atlantic states, and in Charlotte, NC, to serve the South.

Philip D Caine, New England manager for Becco, is in charge of the new Framingham distribution center.



First shipment of Becco hydrogen peroxide from the new distributing center in Framingham, Mass, is loaded into one of the company's fleet of aluminum tank trucks for delivery to a customer in the New England area.

• NEW PRODUCTS AND DEVELOPMENTS •

Phthalogen Brilliant Green IFFB

Verona Dyestuffs, Union, NJ, is now offering Phthalogen Brilliant Green IFFB, the latest addition to its line of Phthalogen Colors. It is described as a new, bright green that is suitable for producing plain shades as well as application prints and resist styles on cellulosic fibers, reportedly producing shades of outstanding light-, wash- and crockfastness.

Used in combination with Phthalogen Brilliant Blue IF3G, it reportedly produces bright aqua and turquoise shades with light- and wetfastness not previously attainable.

Laurel Spotter AF-2

Laurel Soap Mfg Co, Inc, Philadelphia, Pa, has introduced Laurel Spotter AF-2, which is described as a 100%-emulsifiable oil-type product designed for use on synthetic as well as natural fabrics for the removal of oil and grease spots.

Laurel Spotter AF-2 is said to be extremely efficient, having minimum adverse effect on dyeing and finishing operations. It combines with the oil and grease in the spots, thus forming an emulsifiable combination. This is readily removed in normal scouring and boiling-off processes.

Laurel states that the new product is economical and easy to apply. No rubbing is required.

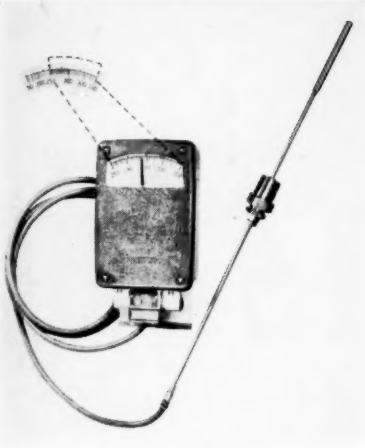
Samples of Laurel Spotter AF-2 are available from Laurel Soap Mfg Co, Inc, Tioga, Thompson and Almond Sts, Philadelphia 34, Pa.

t-Nonylamine

t-Nonylamine, a new member of the t-alkylamine series, has been added to the list of Rohm & Haas Company products. This new primary amine is said to permit wider selection of t-alkylamines over a range of molecular weights from t-butylamine (MW 73) to Primene JM-T (MW 269-311). It is available in commercial quantities.

This group of compounds is said to be recognized for its chemical stability, and noted for its steric-controlled reactivity. The t-alkyl molecular structure reportedly permits ready control of substitution reaction products, and simplifies the preparation of such compounds as aldimines, carbodiimides, and t-alkylcyanamides.

Literature and samples are available from Special Products Department, Rohm & Haas Company, Washington Square, Philadelphia 5, Pa.



Foxboro Model 44 Temperature Transmitter

Indicating Transmitter for Process Temperatures

A compact indicating temperature transmitter has been announced by The Foxboro Company, Foxboro, Mass, for pneumatic transmission of temperature measurement in ranges from 100 to 600° F, with spans of 100 and 200°F. With the upper, more-sensitive portion of the conventional vapor pressure thermal curve expanded over a 4.5-inch scale, the Model 44 Temperature Transmitter reportedly provides as much as 30 to 50 percent greater sensitivity. Use of the expanded scale is said to increase output pressure change per degree temperature change, providing increased receiver control action and excellent readability at both the transmitter and the receiver.

Indication at point of measurement is accomplished by red pointer and black-on-white scale markings with widening divisions across upper portion of range, reportedly providing visibility from as far away as 20 feet.

The fast-responding vapor pressure thermal system includes small (4 x 3/8-inch) bulb, 18-inch bendable bulb extension, adjustable union connection and polyvinyl plastic-covered bronze tubing over copper capillary. The Class II thermal system requires no ambient temperature compensation and may be replaced easily for range change, it is stated. Liquid or gas-filled systems are available for temperatures above 600° F and below 100° F.

Universal mounting bracket offers choice of installation method: wall surface mounting or on a vertical pipe. Output and air supply connections are tapped for 3/4-inch NPT.

Transmitter is 10 1/8-inch high, 5 7/8-inches wide and 4 1/8-inches deep; weighs 10 pounds. Weatherproof case is deep-drawn steel with green baked enamel finish and polyester plastic cover.

Selectrofoam Resin 6207

A new series of low-cost polyester foaming resins reportedly possessing superior characteristics for the manufacture of urethane foamed products has been developed by Pittsburgh Plate Glass Co, 632 Ft Duquesne Blvd, Pittsburgh, Pa. They are said to be superior in may ways to previous polyester and polyether foaming resins.

Selectrofoam Resin 6207, a new flexible foaming resin, reportedly provides, at greatly reduced cost, excellent load-carrying capacity at low densities, higher resilience, good freeze resistance and a soft feel commonly known as "showroom feel."

Foam is manufactured by a one-shot process (no prepolymer required). The resin is especially adapted for large-capacity production machines.

It is reported that the new resin has been successfully foamed in slabs 12 inches thick and there appears to be no reason why it cannot be foamed into thicker slabs if desired. Vertical rise in molds reportedly has been as high as 35 inches with good uniformity of cell structure. The thicker slabs are said to reduce trimming waste. Foams produced are said to be less sensitive to conditions of production than earlier foams.

The new resin may be foamed batchwise, by intermittent procedures, or continously in a foam-making machine, it is stated.

Foams as soft as suede with an unusually soft feel in the comfort area or much stiffer foams reportedly may be made by simple recipe change. Foams may be sliced to form thin, almost transparent sheets for clothing interliners or in any thickness for luxurious cushioning, it is claimed.

The flexible foam has been produced successfully at 2.0 lbs/cu ft, it is stated and proper formulation has given products with excellent compression-set properties particularly after humid aging. Laboratory tests indicate it can be molded without requiring prepolymer preparation.

Technical data sheets and field service available on request.

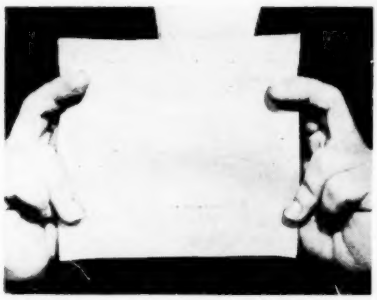


Photo at right shows Permachem-treated cloth, after 4 weeks soil-burial test, to be strong, rugged and clean. Sample not Permachem-treated (left), subjected to same test, is badly mildewed, rotted and unusable.

Permachem Process

Permachem, a new process which is said to render its canvas and greige goods completely mildew-proof, was announced recently by Ohio Falls, Inc, Louisville, Ky. In addition, the fabric is said to be impervious to mold, fungi, germs, and even odors.

It is pointed out by the Company that the process should be a "life-saver" for moisture-exposed products, such as tents, awnings, outdoor furniture, boat canvas and other sports goods.

Impregnation with Permachem is said to render fabrics permanently "germ-proof" against mildew and other enemies of canvas, while leaving them free from odor and color change.

Design Change in CSI Stoll Flex Tester

Custom Scientific Instruments, Inc, Kearny, NJ, has announced a design change in the CSI Stoll Flex Tester. Both the reciprocating flex block and the balanced head are now the same overall dimensions as the CSI Stoll Quartermaster Universal Wear Tester. These design changes were incorporated to aid the operator and to standardize parts for manufacture.

Perma-Plex Fiber Drum; Hedliner Inner Container

Many of Du Pont's dyes and chemical products will be shipped in the future in a new type, two-part container, which reportedly offers the customer the additional advantage of a reusable or salvageable semirigid polyethylene container and a fiber drum.

Replacing the conventional steel drum, the reputedly lighter but equally protective containers consist of an outer fiber drum with steel bottom, an inner container of Du Pont Alathon polyethylene resin, and a metal lid with inside facing of polyethylene, which is said to provide an air- and liquid-tight seal when clamped in place on the fiber drum. Developed from Du Pont suggestions and available to other packagers in 30- and 55-gallon sizes, the new container will be used by Du Pont's Dyes and Chemicals Division for shipment of vat dye pastes, Duponal surface active agents, Zelan durable water repellent, Aridex renewable water repellent, Avitex softeners, Zeset fabric stabilizers, Zelcon fabric conditioners, and Methacrol resin dispersions.

Tests reportedly indicate the two-piece container is satisfactory for both dry materials and any liquids which will not attack polyethylene. An added advantage of the washable polyethylene inner container is that it can be specially treated with a slick, antistick coating that permits removal of all shipped material from the container, particularly liquids, leaving no residue that would require extensive cleaning of the container prior to reuse.

The new container, Du Pont says, meets all requirements of standard drop tests. Weathering characteristics of the fiber drum are completely satisfactory, according to Du Pont tests, and the steel bottom of the drum is raised about three and a half inches to make it adaptable to storage even in wet-floored areas.

Opportunities for reuse of the polyethylene insert after cleaning are limited only by the imagination of the owner, Du Pont notes, and even if sold for scrap polyethylene alone it brings a return of about 50 cents. The outer fiber drum can be reused as a shipping, rubbish, or temporary storage container.

The Hedwin Corp of Baltimore, Md, is producing the Hedliner inner container and lid liner of Du Pont Alathon polyethylene resin while the fiber drum and complete package assembly is being made by National Steel Container Corp of Chicago and marketed under their trade-name, Perma-Plex.

Reciprocating Continuous Dry Mill

A new reciprocating continous dry mill, developed by James Hunter Machine Co, North Adams, Mass, is claimed to deliver finishers a double saving, both in initial cost, and operating labor costs.

When placed in line with a carbonizing range, the mill can be operated by the carbonizer crew. The cloth is introduced and removed from the machine by two sets of nip rolls, running at the same rate as the carbonizer dryer. It is crushed between two sets of rolls which pass the cloth in alternating directions. Two scrays inside the machine hold the cloth while it is being reversed.

The need for timers and costly electric reversal controls is said to be eliminated by the use of a simple detecting device at the bottom of each scray. Activated by the amount of cloth left in the scrays, this device opens one set of rolls and closes the other, thereby reversing the direction of the cloth without altering that of the rollers.

The machine requires approximately the same space as that occupied by a batch dry crusher. However, results are said to be consistently superior to those attainable with a batch dry mill.

High-Purity 2,4 Xylidine

Aceto Chemical Co, Inc, 40-40 Lawrence St, Flushing 54, NY, has announced the availability of an extremely pure meta-xylidine. This intermediate, also known as 2,4 dimethylaniline and 2,4 xylidine, reportedly has a 2,4 content of 96%. Therefore, Aceto reports, their m-xylidine will give greater yields and faster reaction rates. 2,4 xylidine is used in the manufacture of certified food colors and as an intermediate in dyes and pigments manufacture, such as Acetoacet-m-4-xylidide.

Neo-Fat 12

The Armour and Company Chemical Division, Chicago 9, Ill, is now offering lauric acid, Neo-Fat 12, in flake form. The product is packaged in 50-pound multiwall bags.

Neo-Fat 12, which is 96 percent pure lauric acid, formerly was sold only in 55-gallon drums or in tank cars.

The flaked product packaged in bags is said to be particularly convenient for users who do not have bulk storage facilities. It also is designed to permit better inventory control and cleaner plant operation.

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The new color, designated Maxilon Blue RLA, is somewhat redder in shade than Maxilon Blue GLA, previously announced, when compared in natural light, but is much redder in artificial light.

Like its companion color, Maxilon Blue RLA is said to be distinguished by its exceptional lightfastness and good buildup properties. The color yields an interesting range from the lightest pastel to the deepest hues, the production of which reportedly is facilitated by its excellent build-up properties.

The company recommends that Maxilon Blue RLA be applied with the use of an anionic retarding agent, such as Geigy's Irgasol DA, to achieve the utmost in levelness, which reportedly keeps rejects down to the point where stripping becomes insignificant. However, it is claimed, satisfactory stripping results can be obtained, if necessary, by a formula which includes 5% chlorine (15% solution), 3% acetic acid 56 and antichlor with 2% bisulfite, in pastel to light depths. Geigy also points out that Maxilon Blue RLA can be applied with cationic type retarders if desired, although this method is not considered as desirable as the use of an anionic-type retarder.

Like other colors in the series, Maxilon Blue RLA is recommended only for acrylic fibers. It will only stain or tint, in varying degrees. other fibers such as cotton, spun viscose, spun nylon, silk, wool and filament acetate. In cases where it is desired to obtain the same shade on these fibers when blended with or added to fabrics comprised mostly of acrylic fibers, such as in stitching, it is stated that cross-dyeing on materials with affinity for these fibers may be undertaken after the Maxilon application without affecting the latter.

Among the outstanding properties attributed to Maxilon Blue RLA are high lightfastness and excellent exhaustion. Its Fade-Ometer ratings on Orlon 42 are said to be 6-7 for light shades and 7 for the deeper shades. The company claims maximum or near maximum fastness ratings for all other properties. These include: shade change or staining of Orlon or cotton during washing at 160° F; shade change or staining of wool, Orlon and nylon during fulling for 1½ hours; shade change or staining of Orlon or cotton in the acid perspiration test or alkaline perspiration test; drycleaning; carbonizing; decatizing; wetcleaning; water bleeding; sea water; chlorination; sublimation; crocking; wet and dry pressing.

Geigy expects to add other colors for acrylics in the near future.

Formex Cleaner; Formex Finisher

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New Derivatives of Methyl Butynol

Two new derivatives of methyl butynol—methyl butenol and methyl hydroxy butanone——have been announced by Air Reduction Chemical Co, Inc, 150 E 42nd St, New York 17, NY. Methyl butynol will be commercially available early this year when Air Reduction Chemical's new methyl butynol plant at Calvert City, Ky, goes on stream. The two new derivatives, methyl butenol and methyl hydroxy butanone, are now available in development quantities.

Methyl butenol and methyl hydroxy butanone have a wide variety of uses. Both chemicals are suggested as solvent additives, and methyl hydroxy butanone is suggested as an ultraviolet screener used in textile and leather finishes, furniture, plastics and cosmetics to protect against light degradation.

For technical literature, write for bulletin A-7R on methyl butenol and bulletin KA-1R on methyl hydroxy butanone. Samples are also available upon request from Air Reduction Chemical Co.

Versenex 80

Versenex 80, a new chelating agent for use in such industries as textiles and rubber, is being produced in commercial quantities by the Dow Chemical Company.

The product is effective in a broad range of chelating applications but is especially effective in controlling iron ions, according to Dow. Potential uses include the control of iron contamination in peroxide bleach baths and the control of iron and other heavy metals that degrade finished polymerized latex, the company states.

Versenex 80 differs from other Versene products in that it is based on diethylenetriamine while the latter are based on ethylenediamine. Because of its higher molecular weight, more Versenex 80 is needed to chelate a given metal on a weight basis than is the case with other Versene products; however, the chelate structures formed with most metals are stronger and less susceptible to side reactions, Dow reports.

Dow recommends evaluation of Versenex 80 in cases where metal-ion control by other Versene products has met with only borderline success.

Samples of Versenex 80 are available from Dow's Organic Chemical Sales, Midland, Michigan.

Bronze Powders for Printing

Hummel Chemical Company, 90 West Street, New York, NY, is now offering a complete line of bronze powders for textile printing.

Three gold powders are available for roller process textile printing. In addition, nine powders suitable for silk screen application are included in the product line. These nine powders consist of three shades of gold and six shades of aniline-dyed gold powders in shades of blue, green, violet and wine red.

The powders, made especially for textile printing, are said to be nontarnishing and extra brilliant.

Samples and further information are available upon request.

Hummel Chemical advises that submission of problems connected with usage of bronze powders will be welcomed by a staff of technical personnel, which will offer solutions to these problems (wetting, adhesion, suspension, tarnishing, etc). The powders are manufactured by Venus Bronze and Aluminumpulver of Nurnberg, Germany. Hummel Chemical is exclusive sales agent in US. Warehouse stocks will be maintained in Brooklyn, NY.

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IDENTIFICATION OF UNKNOWN SYNTHETIC FIBERS

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Newton, Mass

A method of qualitative analysis for the following synthetic fibers is presented: Dacron, nylon, viscose, acetate, Arnel, Darlan, Acrilan, Creslan, Orlon, Zefran, polyvinyl chloride, alginate, Dynel, Verel, Vicara, and Saran.

The method is primarily microscopical, solubilities being used when necessary or desired for further confirmation. In addition to observation of fiber morphology and optical behavior between crossed polarizers, the method involves observation of the direction of movement of the Becke Line and degree of fiber visibility. These observations are made with the sample successively immersed in one or more of four mounting liquids of known refractive index. This makes possible group separations and final confirmatory identification. Accurate determination of a fiber's refractive index is not necessary.

A brief discussion of principles involved, experimental manipulation, and equipment necessary precedes the analytical procedure.

Accuracy, speed, need of only very small samples, and generally not having to strip dyes are among the advantages of the method.

The purpose of the paper is to aid the practicing analyst, and the method presupposes familiarity with microscopical technique.

INTRODUCTION

THE increasing number of synthetic fibers has made the qualitative analysis of unknown fiber mixtures rather complex. Many techniques for fiber identification are in use and have their value to the analyst. Some are very time consuming, some difficult to carry out, and others give uncertain results.

The purpose of this paper is to report a rapid and accurate analytical procedure for the identification of sixteen synthetic fibers. It is intended as an aid to the practicing analyst, and it should be stated that a certain amount of microscopical technique is necessary to accurately carry out the analysis.

Because microscopical methods are generally the most useful and rapid to apply, this scheme of analysis relies most heavily upon them. Solubilities are used when necessary, and when further confirmation may be desired.

As new fibers appear, they may be included in the general procedure after suitable experimental observation. Occasional checks on commercial samples will show whether any change in fiber properties has occurred due to manufacturing changes.

Only small amounts of sample are required, and the tests may be performed on the original sample as stripping of dyes is rarely needed.

DISCUSSION

In addition to fiber morphology, the main identifying properties used are refractive index and optical behavior between crossed polarizers. This approach was reported by Heyn (*1, 2*) and reference to these articles is recommended. The use of the mounting liquids monochlorobenzene, methyl salicylate and 1-bromonaphthalene[1] was proposed by Heyn (*1*).

In the method to follow, accurate determination of a fiber's refractive index is not necessary. However, accurate observation of the Becke Line is necessary. The main experimental observation to be made is the *direction of movement* of the Becke Line. Briefly, the Becke Line is a fine bright line appearing at the edge of a fiber. This Becke Line appears to move either toward the fiber, or toward the mounting liquid when the microscope is *focused up*. The Becke Line moves toward the medium of higher refractive index when focusing is up. Axial illumination is used, with the microscope condenser diaphragm closed down to yield a moderately narrow cone of light. By means of a cap analyzer[2], which simply slips over the top of the microscope eyepiece, the fiber may be observed with the plane of light either parallel or perpendicular to it. This is accomplished by rotating the eyepiece and cap analyzer, which has the direction of vibration marked on it. Parallel means with the light vibrating in the direction of the long axis of the fiber, and "perpendicular", in the direction of the short axis. A cross hair eyepiece is most helpful. All observations are to be made with the cap analyzer in place and oriented in the direction specified. Only when the fiber is to be examined between crossed polarizers is the substage disc polarizer inserted. This equipment adapts the simpler monocular microscope for this work. Obviously, more elaborate polarizing instruments may be used when available. A magnification of approximately X215 is suggested. Bausch and Lomb neutral tint filters and a blue daylight filter were used at the ribbon filament light source.

When degree of fiber visibility is mentioned, reference is made to fiber substance only, and not to pigment in semidull and dull types.

In noting the direction of Becke Line movement upon focusing the microscope up, choose a portion of the fiber to observe where the width is most uniform, and avoid places where the fiber contour may cause narrowing and twists.

General checking against known fibers is desirable. A cross section of the unknown should be prepared and compared with knowns.

GROUP SEPARATION

GROUP 1———Mount in colorless mineral oil, n = 1.470, and examine under crossed polarizers. Fibers that show polarization colors: Dacron, nylon, viscose.

All other fibers, in all groups, are dull to bright silver when oriented

[1] Liquids of known refractive index may be obtained from Eastman Organic Chemicals, Rochester, NY.

[2] An inexpensive cap analyzer that fits over the eyepiece, and disc polarizer that fits into the substage filter slot, may be obtained from Bausch and Lomb, Rochester, NY.

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